ENGINEERING NEWS.

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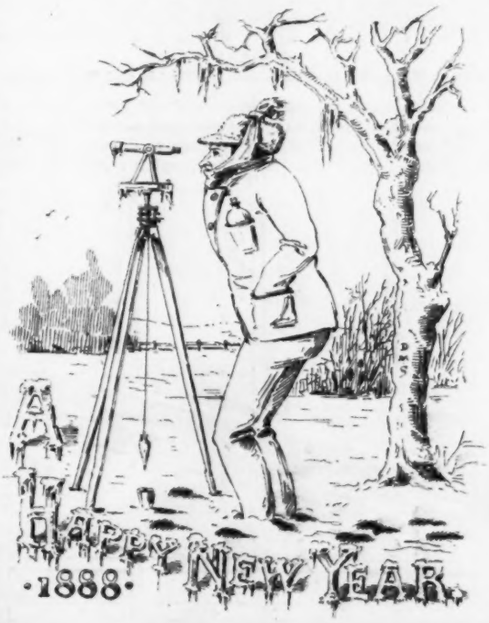
A paper of remarkable and unusual interest was read at the Wednesday meeting of the American Society of Civil Engineers, by Mr. GUSTAV LINDENTHAL, of Pittsburg, Pa., outlining in detail the great project of a six-track railroad suspension bridge over North river, which Mr. LINDENTHAL has been engaged in studying for some time, under auspices which, we are assured, give strong promise of an early beginning of the work. The necessity for some such costly and monumental structure is becoming so clear that only the enormous cost of it (some $15,000,000 for the bridge only) and perhaps doubt as to its unprecedented engineering problems can delay it long. But the cost is certainly not so formidable an obstacle for to-day as was that of the Brooklyn bridge for 1868, when its construction was determined on, nor does vastness of itself imply corresponding technical difficulties, while there is probably no one on either side of the ocean who could be counted on more confidently to deal successfully with the intricate engineering problems involved than Mr. LINDENTHAL. Certainly, no one of the eminent engineers who have already constructed great long-span bridges could have been justly regarded as better equipped for his work at its inception.

As we shall give a full abstract of this project, with illustrations, in a following issue we do not attempt to give more details in this issue than the brief note in another column, but on the great question of "Will it pay?" the figures presented by Mr. LINDENTHAL certainly make out a good *prima facie* case. There are ten different existing roads to use the bridge for both suburban and through traffic. The total cost is estimated at $37,000,000 interest at 5 per cent. on which is $1,850,000. The total passenger movement the first year is estimated at 22,000,000, or 60,000 per day, we presume upon actual statistics gathered from the different railroad companies or ferries, although as to vital detail of the precise basis for this estimate we have not at this writing exact information. The aggregate does not seem improbably large, however, nor does the proposed toll of 10 cts. per passenger seem unreasonably uncollectable, especially as it could be made less for surburban traffic and more for thorough traffic. This would give an income of $2,200,000, with perhaps 20 per cent. more for mail, express, freight and miscellaneous earnings; which should apparently suffice for bare maintenance and interest charge, if, as assumed, all the operating expenses proper would be borne *pro vata* by the rail roads using the bridge, no special cars and engines, of course, being required. We repeat that we do not vouch for the details of these estimates, but they seem reasonable.

THE worst railroad accident of the week was a head collision on the Cincinnati Southern Railway between an express and freight train resulting from a rather novel cause, viz., a confusion of the word Summit with Somerset. They do not look much like each other in type, but let any one write them one under the other in a rapid running hand with a blunt pencil on manifold paper and he will see how such confusion might very easily result. Six persons were killed and 21 injured. Two cars were burned up by fire from the stoves within them and several persons lost their lives thereby, but the winter holocaust which is to stir the whole country has not yet come.

ANOTHER head collision between a fast express and a freight occurred at Meadville, Pa., on the N. Y. P. & O., killing 5 persons and injuring 16, and a tail collision between an express and a freight, painfully injuring a dozen or 15 persons, some fatally.



All these collisions occurred on the same day, indicating that there is still room for improvement in the operating methods of our best lines, for such things need not and should not be. In both the two head collisions the colliding engines reared up facing each other, in broad contrast to the way in which a moving engine will mount one standing still, as shown in the "Question of Dynamics" which we discussed last spring.

THE elevated railway had a narrow escape from the worst accident in its history on the last evening of last year. A stub line to 34th St. ferry joins the Third Ave. line at 34th St., but is operated by an independent shuttle train. The rails were slipping, and a regular train was just pulling out from the station, so as to bring its second car on the junction switch, as the shuttle train was attempting to stop. It could not do this at the usual point, because of the condition of the rails, and so it crushed into the middle of the second car of the train, regularly turning it over on its side, until it was stopped by the new third intermediate track. But for the recent addition of this track the car would inevitably have fallen into the street, and probably have dragged others over with it, if not all three cars behind it. Only 2 persons were injured, although the car and train were crowded, but it was the narrowest escape which the elevated has ever had from dropping a crowded car and train into the street, the fatalities from which might rise to a fearful list.

TWO or three hours later the Brooklyn bridge was also closing up the year with a frog derailment which caused suspension of cable traffic till next morning. The frogs and switches are excessively sharp because of the contracted room and derailments have been not infrequent in consequence the last one before this having been some six weeks since. Luckily, the rush hours were over, but at 8.25 P. M. there is still a pretty heavy traffic which had to be handled thereafter from a single platform, and the resulting jam and confusion was very great for a time, between incoming and outgoing traffic as the platforms are all too narrow for either alone. As things are now, no accidents to persons can well result from these derailments, since they occur only to empty trains in switching from one track to another, there being no frogs or switches in the track passed over by loaded trains, but they well illustrate the probable consequences of introducing frogs and switches on the service tracks proper, on which we have had occasion to comment heretofore.

THE new Mayor of Brooklyn devotes the principal part of his message to an earnest argument against the continued existence of a separate Board of Trustees of the Brooklyn Bridge, authorized to receive and disburse moneys regardless of the city officials. In his argument he makes one statement of especial interest, which will surprise many people, that "the police force of the bridge numbers 96 men, that of the entire city (of Brooklyn) besides being 929, including detectives." This certainly does seem a liberal allowance of policemen, since if the whole force were stationed at once on the bridge there would be a policeman for every 62½ ft. of the structure and approaches, or allowing only half the force to be on duty at once, one every 125 ft.; but this apparently excessive force ceases to be quite so surprising when it is known that 7 policemen are required on a single platform for loading three car trains during the rush hours, in order to handle the crowd, and prevent them from crowding each other off the platform, in addition to the regular staff of ticket collectors, etc., and of four trainmen to each train.

The New York Central & Hudson River Railroad has definitely adopted the policy of flooring all its small bridges and track openings, from about 100 ft span down, with buckle-plate floors, and carrying the ballast directly over them, so that there will be practically no break in the continuity of the track surface except at the few very large structures. We say "buckle-plate" floors, as that term gives the clearest idea in a single word of its character, but the floor is not made of buckle plates proper, but of rolled iron members as we shall show later by illustrations.

The Incline Railway at Lookout Mountain.*

Among the engineering plants with new features and deserving details which are constantly being brought to the working stage in Southern States by the generous expenditure of capital, none can exceed in interest, whether to the public or the profession, the incline-railway built from base to submit of Lookout Mountain, near Chattanooga, Tennessee.

Although it is situated on main lines of travel between the North and South, comparatively few of our people in search of health or recreation have availed themselves of the benefits and charms which latitude and altitude here offer. The expense and delays attending sight-seeing may heretofore have deterred many from visiting the spot, or the time may not have been opportune for calling attention to this section. Whatever the reason for past neglect in this respect, the time has come at last for a more thorough utilization of the scenic and sanitary resources of the region; and we have, as a result of combined talent and capital, a completed line for pleasure-travel which relegates to the past the wrangling driver of a licensed livery, or the long tiresome climb over dusty roads, to visit the glories of Lookout mountain.

Volumes have been written, but no pen can describe the panorama of miles of undulating country traversed by the Tennessee river, and the scores of miles of lower mountain ranges which are spread out in every direction below the grand old mountain summit. Perhaps no single eyrie in the broad land can offer the charm of civilization and primitive grandeur so closely allied and so strongly blended as here from Lookout, the sentinel peak which guards the middle break in the southern Appalachian chain and the opening of this railway system brings it within easy reach of all.

Much geological and historical interest centers in this section of the middle mountain-country. Of its geology, the Transactions of the Institute contain many particulars. Of its history, the most recent and important part is fresh in our memories, and the region itself still abounds in evidences of the struggles for mastery and occupation of this strategic position during the late war.

Six minutes of time will now transport the traveler from sordid earth to ozone of the cloud-plane and unroll before him the magnificent view which has hitherto been obtainable only at the cost of a tedious ascent.

As compared with other inclines employed to overcome mountain heights, this work is a new departure; and the details here given by which many of the problems which vex the mining engineer also are cleverly solved will doubtless prove interesting to members of the Institute.

FIG. 1.

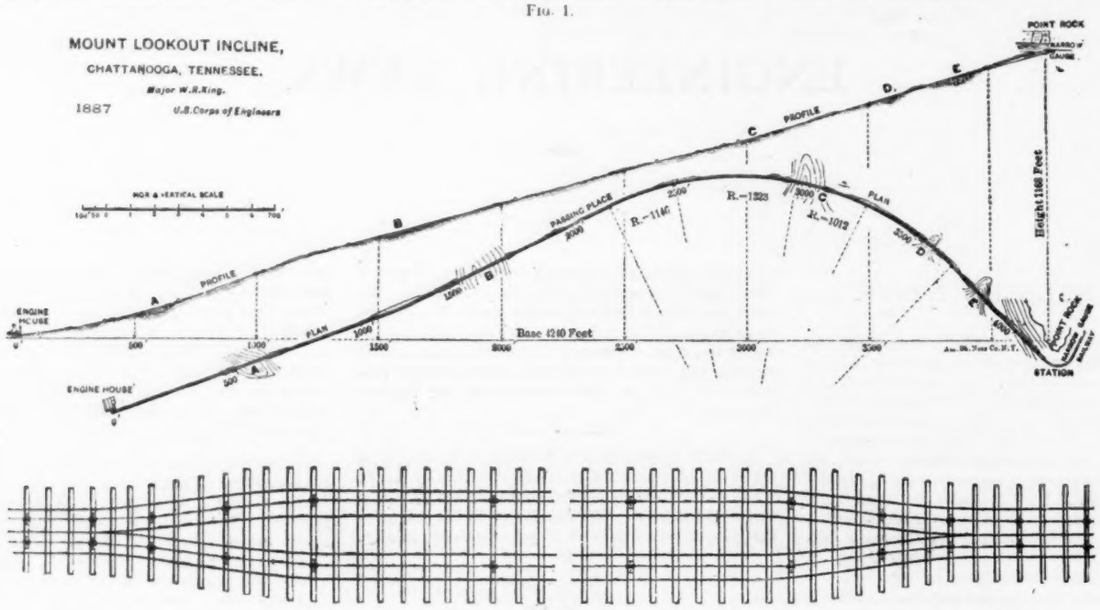
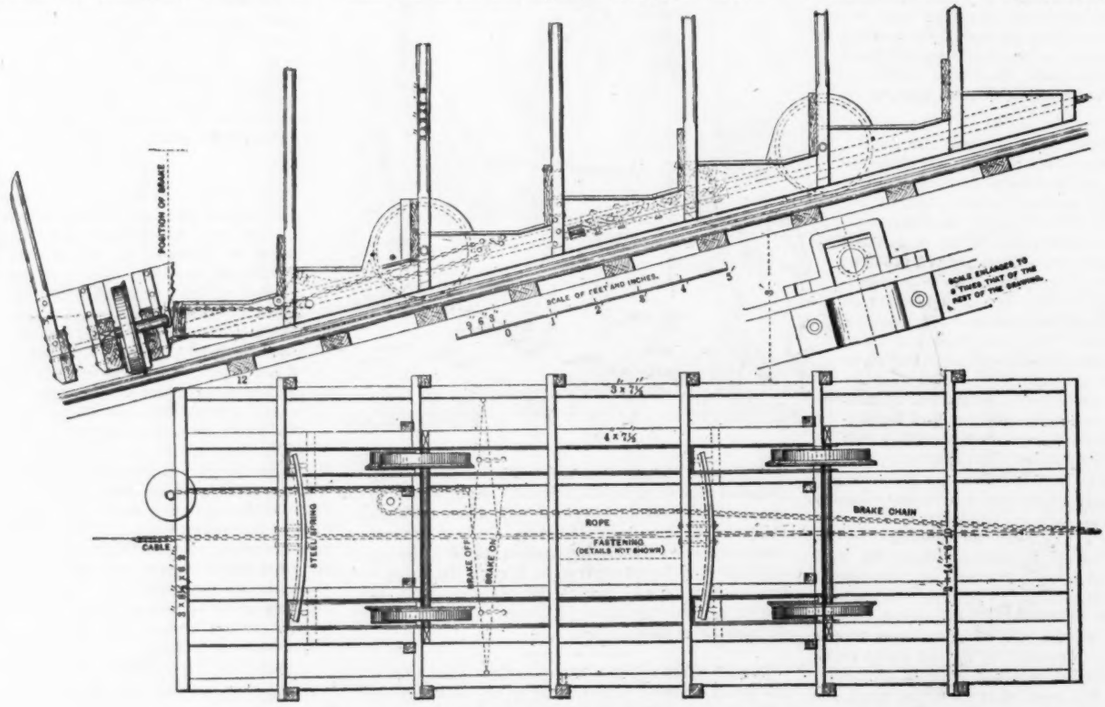


FIG. 2.

Lookout Mountain Incline Railway; Profile and Track plan.

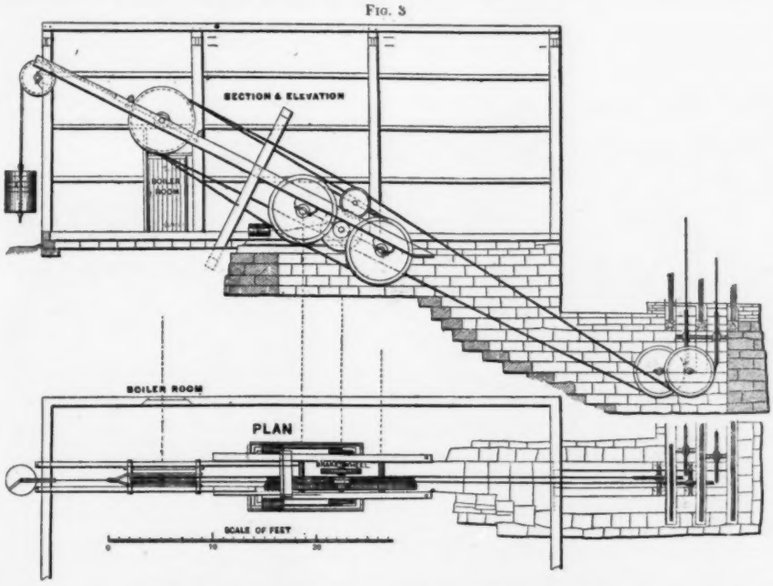


Lookout Mountain Incline Railway; Elevation and Plan of Cars.

*A paper by W. H. ADAMS, M. E., New York, before the American Institute of Mining Engineers.

I am indebted to Major W. R. KING, U. S. Engineers, for the details herewith presented, the project being his own, conceived during his residence in Chattanooga, and completed under his personal supervision. If Major KING were one of the brotherhood of mining engineers, whose skill is so generally hidden from sight and sorely tried by the adverse circumstances of an underground existence, and had chosen an example to benefit his fellow-workers while serving as the practical solution of a problem of great value to the public at large, he could not have offered a more genuine surprise than is met

FIG. 3

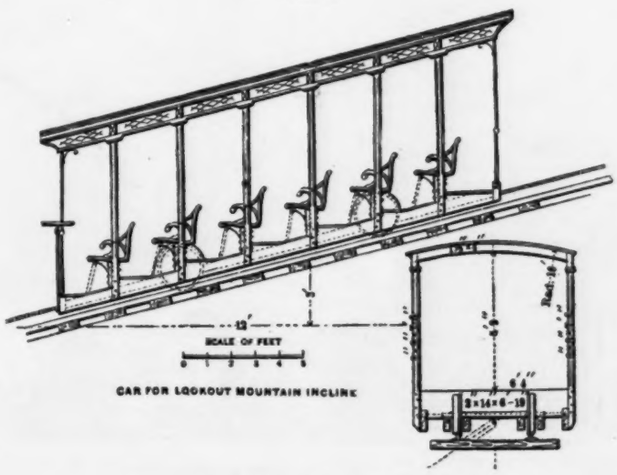


Lookout Mountain Incline Railway; Engine-Plant.

with in this railway, so quitely and expeditiously brought to a finish within the present year.

By reference to Fig. 1, which shows the railway in plan and profile, with cuts, fills, trestles, etc., it will be seen that the line is straight for 1250 ft., commencing at the base, curves to the left for 250 ft. thence runs in a tangent about 800 ft. (which distance covers the switches or passing-points for the cars),

FIG. 4.



Lookout Mountain Incline Railway; Cars.

thence curves to the right for 1400 ft. and finishes with a stretch of straight line for 600 ft. to the base of bare rock which marks the crest of the mountain, 1500 ft. above the river-level. The length of the track is 4360 ft. and the elevation attained is 1170 ft. or, say, 1 ft. of rise to 3 and ¾ of length. The problems required to be solved, the difficulties encountered in the nature of the surface, and the methods of overcoming all obstacles will be partially appreciated by reference to plans and photographs, but can be wholly understood by personal inspection only.

Cable lines in cities are the nearest approach to the methods here employed, but a close study of the special features which mark this new departure for surface-working will be of particular benefit to those engaged in mine-engineering.

Midway on the plan (Fig. 1, enlarged in Fig. 2), the outer rails are shown as diverging, and the central rail opens out, or doubles, for a distance of 200 ft. forming two independent tracks or switches. This very unusual plan of a three-rail road, from end to end, was adopted for many reasons, prominent among which are:

1. No movable parts are used at any point in the track; therefore there is no risk of accidents from the failure of parts to work under the varying conditions of such service.

2. Solidity is assured by the extra width of the road-bed; therefore steadiness of running at high speed is practicable.

3. Sufficient space and play are given for the rapidly-moving cables to hold the center of the separated tracks at all times, the grooved guide-wheels, carefully spaced, holding the cars to the curves as evenly and truly as on the straight track.

The rails are of steel, 25 lbs. to the yard, and laid on cedar ties 9 ft. long. No spikes are used, the rails being secured by heavy lag-screws 5 ins. long, the heads of which are reinforced by wrought-iron washers 2×3 ins. which grip the base of the rail.

The cable consists of two sections. The upper one, 4,360 ft. long, and depended upon for the real work, is passed over an 8-ft. sheave at the summit, and to its ends are attached the two cars, giving the well-known balanced hoist where power is applied at the upper ends. In this case, owing to the necessity for applying the power to the lower end of the system, the ends are spliced below the cars to the two ends of a second section of cable, thus forming a continuous driving-rope. The center of the lower section passes over the grooved driving and tightening-pulleys, arranged as shown in Fig. 3.

A large surplus of strength is allowed for in the upper or working cable, the maximum load being 5 tons, while the breaking strain is 50 tons. This cable is 1¼ ins. in diameter, and composed of six strands of nineteen wires each.

The driving-cable is one inch in diameter, with the same number of wires. The sheave at the summit is held in place by a wooden frame anchored to masonry piers which rest upon and are bolted to the original rock.

Fig. 3 shows a section and elevation of the engine-house and plant.

The engines, built by Wheeland, of Chattanooga, have two cylinders, 12×18 ins. connected to the main shaft, and a 20-in. steel pinion and two 80-in. gear-wheels actuate the two 80-in. double and triple-grooved driving-sheaves.

The lead of the cable passes around the driving-sheaves, as shown in Fig. 3, and around a pair of smaller sheaves fixed in a sliding frame, to which is attached a counterpoise, serving to keep the cable uniformly taut, and allowing for changes of temperature or strains of any violent nature.

The engines are controlled absolutely by a system of levers extending into the tower of the engine-house, the engineer having an unobstructed view of the cars at nearly all points on the line.

The boilers carry 75 lbs. working-pressure, and consume from 1600 to 2000 lbs. of bituminous coal per day (the cars making from 18 to 24 trips), or about 90 lbs. of coal per round trip.

The throttle, an ordinary 4-inch globe valve, is only opened from one to two-thirds of a turn for the heaviest loads, while the full opening requires five complete turns,

With this small amount of steam the engines make about 160 revolutions per minute, the valves being set to cut off at two-thirds stroke. Late indicator-diagrams show that considerable improvement can yet be made in the setting of the valves; but these facts of present working will give a clear idea of the small amount of friction over the 9000 ft. of wire rope. The expenditure of power is surprisingly slight, when account is taken of the stiffness of cordage, weight of cable resting upon and moved rapidly over 150 grooved pulleys and passed at right angles through the power-plant, head and tail-pulleys, etc.

The importance of telegraphic relations between the cars and engine-room was duly considered, and a very simple plan was devised by which either conductor can signal directly to the engineer from any part of the line whether the car is moving or standing still.

The arrangement may be readily described without drawings, as follows: A small 8-cell Leclanche battery and an electric gong are located in the engine-room. One pole of the battery is connected with a bearing of the main sheaves and thus with the cable, which forms the ground circuit. The other pole is connected through the magnets of the gong to an ordinary telegraph wire stretched between the rails and supported by insulators *that do not rise above it*, the wire being about six inches above the ties. To complete the circuit all that is necessary is to connect this wire with the cable, and this can be done at any point of the line by pressing a spring upon the wire, the other end of the spring being connected with the cable where it is attached to the car.

To guard against mistakes or possible failures to make the proper signal when in motion, it is understood *that any signal whatever*, when the engine is in motion, means "stop!" but a "start" requires a certain definite signal which can of course be easily and deliberately made, as the car must be standing still when such a signal is required. This last signal is such that it could hardly be counterfeited by accidental contact of the wires or by malicious persons. It should be noticed that, even if the cable were to be broken at any point, there will always be a connection one way or the other back to the en-

gine-house, and if a car should jump the track the spring would come in contact with the insulated wire and thus give an instant signal to stop the engine.

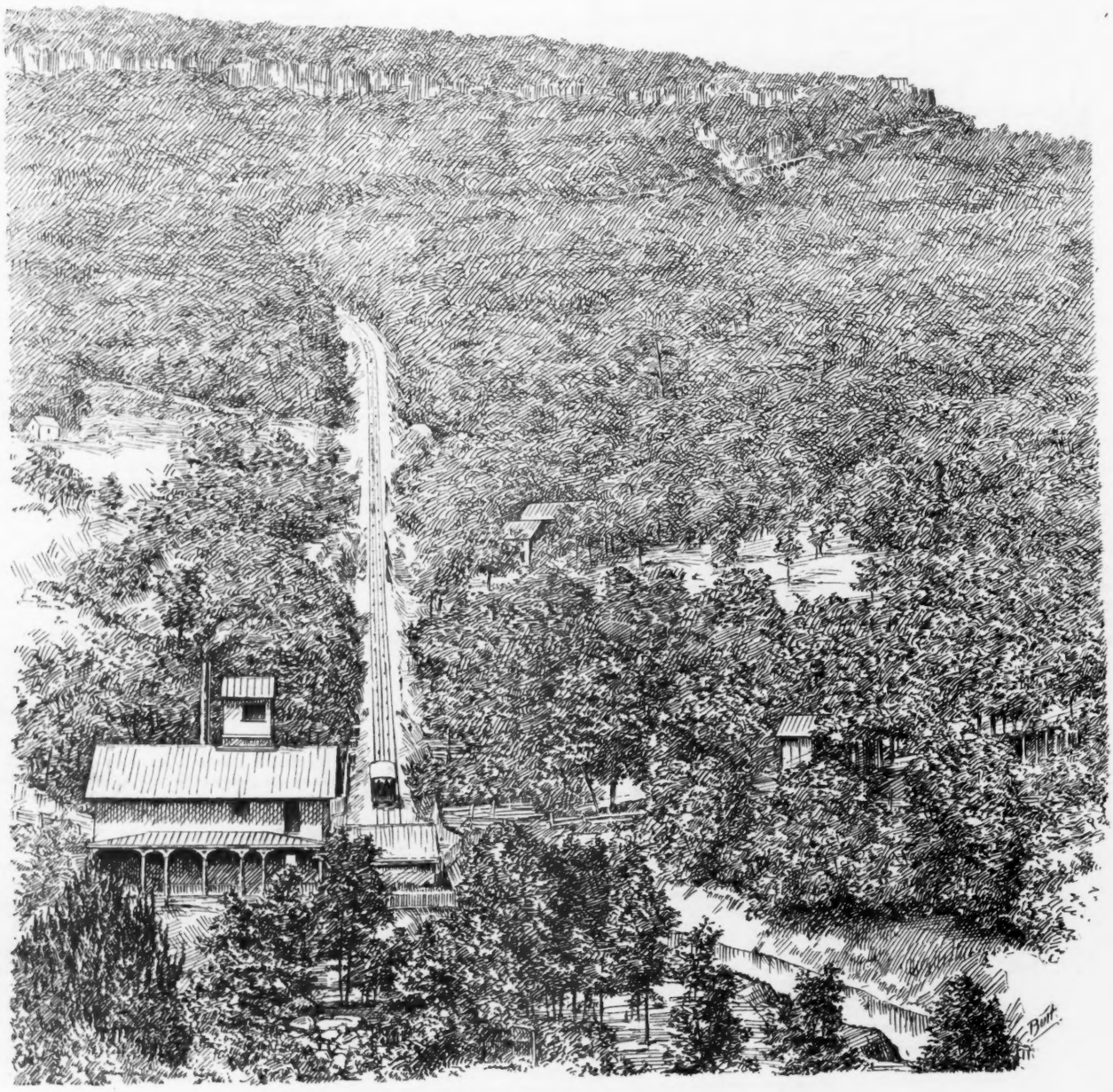
Fig. 4 shows the construction of the cars, which were built as low as possible, and are provided with a special form of brake shown in Fig. 5. This brake acts in an entirely different manner from the common style of car-brake, the conductor being obliged to hold it off during the entire trip, or whenever the car is in motion. If, by accident or design, the hand-wheel is released, the brake is instantly forced under and against the front of each wheel, so as to lift the wheels entirely off the track, thus converting the car into a sled, of which the brakes are the runners.

The bottoms of the brakes now have soles of wrought-iron with short steel pins (24 in number) projecting slightly from the surface and sharpened like an engraver's tool. It is proposed to try a shoe with a **A** shaped groove to take the head of the rail, the amount of friction being increased by the sharpness of the angle into which the head of the rail will be wedged by the weight of the car and load

An automatic attachment causes the brake to set in the same manner in case the cable should part, even if the conductor should continue to hold on to the wheel; and still another and independent automatic grip is contemplated, to be actuated by a governor attached to the car-axle.

It should be added that the springs which acuate the brakes are not required to be bent more than six to eight minutes at a time, and will not be likely to take a "set" as is the case with springs on some forms of hoisting machinery which are kept under strain for months at a time.

Fig. 6 is a view on the upper portion of the incline,



Incline Railway up Lookout Mt.; General View.

showing a car crossing one of the trestles. The oblique wheels carrying the cable are also seen. As this illustration is a Levytype from a photographic negative, taken on a bright day, the shadows of the two cables are very distinct. They should not be mistaken for extra cables.

Fig. 7 is a view from the lower terminal, showing in perspective nearly the whole of the line. By comparison with Fig. 1, it gives a good notion of the work and of the topographical difficulties surmounted.

An Economical Method of Heating and Ventilating an Office and Warehouse Building.*

Various methods have been devised and are in use for heating large rooms, manufactories, and public buildings. Some of them take into consideration the ventilation of the buildings as well.

I will describe briefly a method I have had in use in my store at 135 North Third Street, Philadelphia, Pa., for the past two winters, which has been very satisfactory. It has been very economical, and dependence could be placed upon its efficiency at all times, no matter what the condition of the weather might be.

A reference to the accompanying sketch will clearly give a correct understanding of the arrangement. (Fig. 57.)

An exhaust fan driven direct by a small upright engine is connected with a "patent air-heater" placed in the basement at the front of the store by an 18-in. galvanized pipe.

*By Henry I. Snell, Philadelphia, Pa.. Presented at the XVIth Meeting, Philadelphia, 1887. American Society of Mechanical Engineers.

An upright boiler in the basement furnishes steam to run the engine; the exhaust steam from the engine is delivered through the exhaust pipe into the base of the air-heater on one side, and the drip and condensed steam is conveyed away through a pipe at the other.

The exhaust steam of the engine furnishes all the heat usually used, but as a precaution, and for use early in the morning, in extremely cold weather, or for use in very moderate weather, in the middle of the day, when it is unnecessary to run the engine, a small live steam pipe is connected with the base of the heater. The fan runs at a very low speed, and is perfectly noiseless. In my case, no conducting pipes for the distribution of the air are necessary, and the variations of temperature in different parts of the store are not observable with the ordinary commercial thermometer. By examining the sketch, it will be seen the store itself becomes one large conducting tube—and the air is used over and over again, enough fresh air coming in through openings

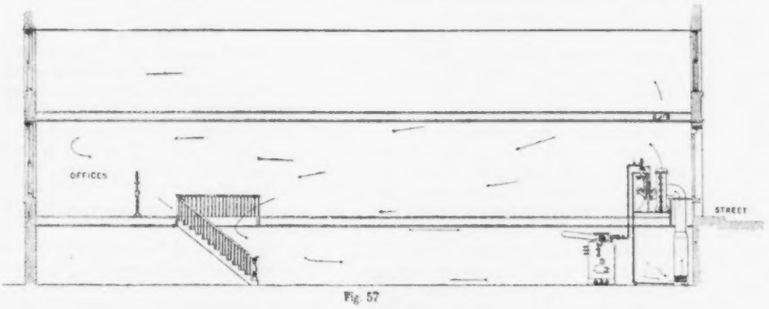


Fig. 57

Heating and Ventilating Offices.

around the windows and through doors constantly being opened. An opening near the bottom of the heater has been provided, and can be used for supplying fresh air when greater ventilation and less heat are required.

The following data are submitted:

Length of store, 95 ft.; width of store, 24 ft.; height of basement, 8 ft. 6 ins. in the clear; height of first or main floor, 13 ft. in the clear; height of second floor, 11 ft. 6 ins. in the clear.*

The side walls are brick, inside walls plastered, and have no openings.

The front is almost wholly of glass, and the large windows are hinged, and open or close like a door. They are not very tight. About three-fourths of the wall surface of the back end is composed of glass; the rest of brick.

The building is five stories and basement, and I only occupy and heat the first and second stories and basement, but I think I could easily heat the whole with my apparatus at a very little increase of cost in fuel.

The engine that drives the fan is 3 ins. in diameter, and has 3 ins. stroke. The wheel in the fan is 36 ins. diameter, and 13¾ ins. wide at the outlet of wheel; the area of discharge of blower 1.76 sq. ft. and the inlet is same size. The heater is about 3 ft. wide, 6 ft. 6 ins. high and 20 ft. deep, and filled with 588 ft. of 1-in. steam pipe. I am so well satisfied with the results I get from this apparatus, that I have not made any close and accurate experiments of what I can do with it. I know from the cost of my fuel that the expense of heating all I occupy is about the same as I formerly paid when I only heated the offices which were partitioned from floor to ceiling and heated with open grate. I might return the condensed water from the heater to the boiler and make a greater saving. This is not done at present.

Possibly before the meeting of the Society we may have some cold weather, requiring the use of the apparatus, and if this paper produces any discussion by the members, some careful experiments upon its performances may be laid before them; but at present I can give only the results of one imperfect and incomplete observation, made during December, when the outside temperature was 45°.

Temperature of the air on its return and just before entering the heater, 59°.

Temperature of air issuing from the mouth of the blower after passing through the heater, 112°.

Average temperature of air in the room of the main store, on first floor, 75°.

Pressure of steam in the boiler by gauge, 40 lbs.

Revolutions of blower, 113 per minute.

I have made arrangements by which I can measure the evaporation of boiler, condensation by the heater, steam pressure at cylinder, and temperatures at various places in the rooms, but to put them in operation I require another element, which I can only obtain later in the season, viz., cold weather.

I have no apparatus which will give more heat units than contained in the steam, but I do think I have one which will utilize those obtained to the greatest advantage, and one that will work when I want it to, and as I want it to, independent of atmospheric condition even when the winds blow where they list. One self-evident advantage must be apparent from the better distribution of the heat throughout the room, having a much less difference between the temperature at the top of a room similar to the one above described and at the bottom. A room 13 ft. high heated with furnaces or radiators will at times be 25° warmer at the top than near the floor. When this air is more uniformly mixed as it is with a blower, a less expenditure for fuel will be the result and more agreeable conditions realized.

*This floor I only heat occasionally, as it is used principally for the storage of machinery. When necessary to heat it I open the damper shown directly over the mouth of the blower, and sufficient heated air will be driven through the opening to heat it comfortably in a few minutes.

The Oredon Reservoir (France).

The Oredon reservoir forms part of a scheme for the distribution of the waters of the Neste for irrigating the region lying at the foot of the Pyrrenees, near the plain of Lannemezan. The following notes on the construction of this reservoir are taken from *Les Annales des Pont et Chaussees*, by the Chief Engineer, M. MICHELIER:

The origin of this reservoir is a lake of the same name with an area of 24 hectares. This lake is transformed into a storage reservoir by a barrage across the natural outlet. This barrage, or dam, is an embankment protected on the up-stream slope by a covering of beton which is protected against frost by a sheeting of dry stone, 3.28 ft. thick.

The interesting point in the construction of this dam is that the principal agent employed was water. In the trench provided for the railway bringing in the earth was a stream of water with a capacity of 15 litres per second. At the dam this water was discharged by a wheel into a wooden conduit placed 2.62 ft. below the line of rails. This conduit is prolonged as the filling advances and discharges the water at the point where the load is dumped. As soon as two or three wagon-loads of earth have been dumped the stream of water is turned on and the current washes the sand, earth and small stones towards the foot of the slope, the surplus water flowing away. The result was a very compact bank with little or no after settlement.

In the lining of this dam, as the most excellent Lime of Theil used in the beton lining is permeable by water, the engineer has attempted to remedy this defect by a bituminous skin about ¼ in. thick made as follows:

Mineral tar	10.5 litres.
Powdered Lime of Theil	14.0 "
Fine, dry sand	42.0 "

This bitumen was applied hot and was immediately rammed. If the paste was not too dry the tar would come to the surface under the ramming and the result was considered all right. If the paste was too dry, it became granular and then had to be taken up and again put into the kettle and freshened by the addition of more tar.

This lining was at first sound and economical; but after six years service it showed signs of failing and another coating has been put in place made of 9 parts of tar to 8 parts of powdered lime. This last had given very good results in lining the canals on the river Neste.

The Schultz Collision Apron.*

The progress of the age has been marked by improvements in ship building, machinery and general equipment so that a sea voyage across the stormy Atlantic, can be made with comparative ease and comfort. The investigations of meteorological conditions, the laws of storms and the application of oil on seas to lessen the dangerous effect of heavy waves have contributed to give a degree of control over the elements, which a few years ago would have been thought to be impossible.

The causes of marine casualties have been reduced to a minimum and careful navigation will eliminate all dangers except collision. It seems to be extremely difficult to make such rules of the road at sea as to remove all danger of collision. In fact the great speed attained by the fast Transatlantic liners, makes this difficulty almost insurmountable. In thick weather the range of vision is very limited, in fogs it often happens that one cannot see a ship's length ahead and in murky weather 5 or 6 miles is the maximum distance a bright lookout can see ahead. At night one's vision in such weather is limited to two or three miles unless electric lights be shown by the meeting vessel.

These fast steamers make 20 miles an hour, and two such vessels would approach each other at the rate of 40 miles, or 1 mile in 1 min. and 30 sec., or 58 ft. in 1 sec.

This speed is by law decreased in thick fogs, but in practice the decrease amounts to but little and it is safe to say that two fast steamers would approach each other at rate of 400 ft. in 10 sec. This speed is so great that it is wonderful we do not hear of many more collisions, for when one cannot see beyond 400 ft. in some fogs it is not probable that any measure could be taken in the short space of 10 seconds to avoid collision. Indeed, if the vessel be seen, and orders be issued immediately, there is no vessel with such perfect steering arrangement that it would even begin to act in that space of time. It is simply impossible to avoid collision in that case if the courses steered should lead to that event. Nothing can be done to prevent the collision. The result is simply the mathematical inevitable.

Prescribed routes eastward and westward wil obviate the risk, but this can only be in mid-ocean; and can not apply near our ports or in the English channel. It only remains to reduce and limit the effect of the collision.

The last hope for the safety of the lives of the passengers and crew rests in the boats, and when it becomes necessary to use them, the awful discovery of their insufficiency is realized at the most critical time. Panic ensues, and a horrible account of disaster fills the press and brings grief and woe to the homes of those sacrificed.

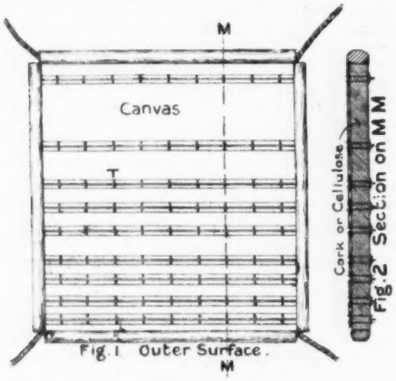
Regulations and laws have been exhausted to compel passenger steamers to carry sufficient boats, but these boats are often injured by the very disaster from which they are intended to serve as a rescue And in the face of death, with panic stricken men and women, boats cannot be launched in safety except under most favorable circumstances.

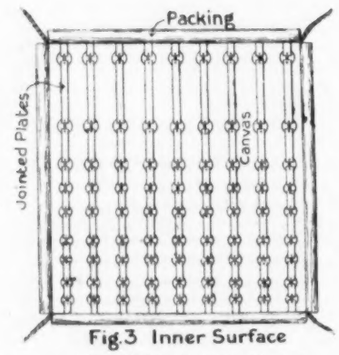
The only remedy lies in finding some sure method to keep the ship afloat after collision; this will be found to be feasible by the use of collision aprons, or mattresses invented by Mr. SCHULTZ. In the English navy there used to be a prescribed drill for handling a sail to serve as a collision mat, but the use of an awning or sail does not suffice, because there was no way of keeping the mat in place so as to be efficient in a seaway. This may be readily seen from a brief consideration of the pressure exerted upon a tarpaulin or sail used as

*Written for ENGINEERING NEWS, by an officer of the U. S. Navy.

a mat to close a breach in the ship's side. The pressure of water on an opening below the water line, 6 by 12 ft. is about 35,000 lbs., an opening of 9 by 30 ft. about 80,000 lbs., and one 12 by 36, about 150,000 lbs., and then for every increase of 3 ft. in depth, the pressures would increase by 18,000, 35,000 and 55,000 lbs. respectively, so that it is not surprising that the use of a simple sail over such large holes fails to keep the water out.

In the case of the *Oregon* everything was done to stop the hole, mattresses, planks, etc., were all sucked in and the sail acted like a sieve. The Cunard Co. have sought to utilize the best means for the safety of the passengers in their steamers, but measures must be taken to repair a breach caused by collision. Fogs cannot be prevented and the





The Schultz Collision Apron.

human ear and sight are liable to fail at critical times, especially since the great speeds demand such instant measures to avoid colliding. Water-tight bulkheads are built to enable the ship to float when one or more compartments are flooded, but this has failed so often that other measures are imperative.

Two steamers of 3,000 tons each, going at a reduced speed of 15 knots, would each deliver a blow of 14,200 million foot tons, and no matter where the blow was received it would be transmitted throughout the ship, and cause the bulkheads to leak, so that they are not always reliable. There are, however, circumstances which will, in many cases, materially reduce the force of the blow, such as indirect action, gliding or glancing blows, but the inadequacy of water-tight bulkheads is clearly established by frequent failures, as in the *Oregon*, *Scholten*, and other disastrous collisions.

There are three forms of the Schultz Collision Aprons, viz.: rollable apron, plain apron and netting apron. The rollable form is the one which is most likely to be adopted in general use.

The Rollable Schultz Collision apron consists of a mattress or packing made in a peculiar manner with one side waterproof to stand a pressure of about 40 lbs. per sq. in. The outer surface of the apron carries horizontal steel T-rails at short but irregular distances apart. These T-rails are riveted through to steel washers on the inner side and the several rows of washers are connected vertically by loosely fitting plates, these plates prevent indenting the mattress between the horizontal T rails and relieve some of the strain of the weight of the rails. A roll of packing is secured to the edges over the steel plates on the inner side, which then gives vertical support and prevents water flowing in by closing watertight against the ship's side.

When not in use the apron is rolled up and stowed away on deck ready for immediate use in emergency; certain men being regularly drilled and stationed to handle the apron in the same way that others are drilled for lowering boats, etc. A rollable apron large enough to cover a hole 4×8 ft. can easily be handled by eight men. An apron of 6×12 weighs about 1200 lbs.

The locality of the breach having been ascertained and the vessel stopped, the apron will be taken to the rail over the breach. The head lines will be secured to allow the upper edge to come about a foot above the breach. When the upper edge of the apron is lowered to its proper position, the stops on the rolling lines should be released and allow the apron to unroll, and the pressure of the water will force the apron close to the breach, the horizontal T-rail and loosely jointed plates will prevent the aprons being sucked into the breach by the pressure of water. Forward and after guys will be advisable and bottom guys to be passed under the keel up on the opposite side will also be necessary. As soon as the apron covers the breach the flow of water into the ship will cease. The apron can then be more securely fastened by reeving lines inboard through the loosely jointed vertical plates.

The sketches illustrate the salient features. The outer surface is waterproof and carries the steel T-rails. The packing is of cork, or cellulose preferred, and the inner surface of canvas with the loosely jointed vertical plates and washers. The edges have rolls of packing to make the apron fit in closer to the ship's side.

The rolled apron looks to be heavy and unwieldy, but the material is all so light that the largest sizes, 12 ft. deep by 36 ft. long can be handled by 10 or 12 men with others to tend the guys until the rolling stops are released.

Fig. 1 represents the apron's exterior side. Fig. 2 is a section through *M M*, showing rivets, etc. Fig. 3 is a view of the inward side of the apron, showing the short plates which fit loosely but give vertical stiffness when hanging as in this figure or in place over a hole in a vessel's side.

The exterior surface is waterproof, and the apron is stiffened horizontally by T-rails and vertically by short plates, so that the effect of the pressure of water is to keep the apron in place, while it cannot be drawn into the hole. The apron may be of any desired dimensions, it should be deep enough to extend below the bilges and wide enough to lap one compartment so that the edges may butt against solid uninjured frames. Experiments have established the efficiency of this apron, and in view of the security it gives to keep the ship afloat, the apparent bulk as rolled up will not be objectionable.

The Great Dams of the World.

So complete a summary of all that has been done the world over in the way of high masonry dams was never before collected together on one sheet as in that which we are enabled to publish this week from the recently issued report of B. S. CHURCH, Chief Engineer, and A. FTELEY, Consulting Engineer, on the great Quaker Bridge Dam, the early construction of which is now practically assured, and which will doubtless for a long time to come lead the list of such structures, with a tremendous gap between it and the next one in magnitude. The studies for such a work have such special interest that we shall publish hereafter the bulk of the technical reports referred to, but in the meantime, as a preliminary thereto, we give this week merely the sections and ground plans of all the great dams of of the world, with a table of their leading dimensions.

A PASSENGER car of a new type is being constructed in Boston. It is cylindrical in form and made entirely of steel. The frame is completed, and work upon the interior has begun. It is proposed to make the car the most magnificent and complete in every detail. It is to be used as a private car, and is therefore to be provided with every improvement and convenience for comfort. The car is 62 ft. over all, and on each side there are eleven windows of unusual size, each filled with a single pane of heavy glass. The cylindrical form of the car gives a very wide appearance to the interior, although it is really the same width as a Pullman car.

Improvement of the Water Supply of Allegheny City.

Under instructions from the Water Committee of the City of Allegheny, Prof. D. M. GREENE, of Troy, N. Y., has reported upon a better water supply for that city in connection with plans submitted by the city engineer and the superintendent of the waterworks.

The consulting engineer recommends as a source of the supply the northerly channel of the river about 9 miles from the city; he would there form a basin by piling and rip-rap with coarse gravel. The reservoir site suggested has an elevation of 273½ ft. above city datum, and 105,000,000 galls. of water may be stored there. As the Allegheny river contains much suspended matter at times, settling reservoirs should be provided in any proper scheme.

For these works two plans have been prepared. Each takes the water from the point above mentioned; the first plan provides for a pumping plant, 4,000 ft. of 50-in. force-main, a double reservoir holding 105,000,000 galls., and a delivery main of 5 ft. diameter and 9 miles long. The estimated cost of Plan No. 1 is $2,309,765.50, including 10 per cent. for contingencies. Plan No. 2 contemplates the erection of a pumping plant, to deliver through a 5 ft. steel main ($\frac{7}{16}$-in. thick as against $\frac{9}{16}$-in. in the first plan) to a suitable well at the present pumping station, to be there repumped to the present reservoir. The estimated cost of Plan No. 2 is $781,418.60, including two 5,000,000 galls. engines, to replace the three older present engines.

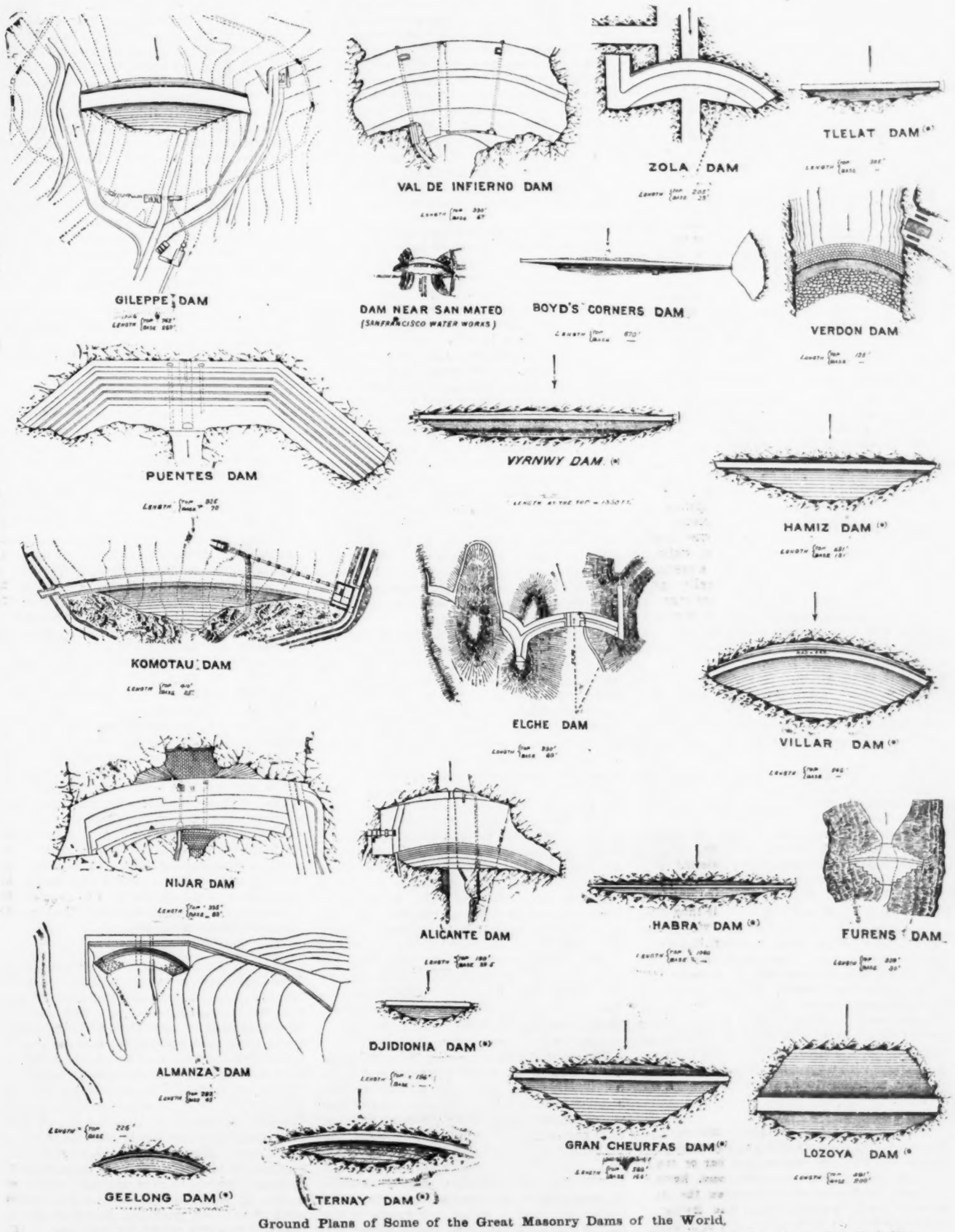
Prof. GREENE recommends that plan No. 1 be adopted as the ultimate general plan, and that the works be designed on a basis for a daily supply of 30,000,000 galls. at least. Second: That the second plan be modified by substituting a heavier delivery main, so that it may become a part of the general plan. Third: That the second plan so modified be first executed, so that the new supply may become early available at the minimum expenditure of money. Fourth: That the remainder of the work be begun at such time as shall seem expedient; this remainder including the force-main, reservoirs and so much of the delivery-main as shall be needed to connect the new reservoirs with the main of the second plan. The estimated cost of executing this modified plan is $1,514,060.40; to complete the general plan would cost $1,067,876.60 additional, or $2,581,936, in total.

In recommending one large delivery main instead of two smaller ones, Prof. GREENE depends upon the material selected for this main as rendering a break very improbable. The static head on this main would be 280 ft., and when delivering at the rate of 30,000,000 galls. daily the frictional head would be 23.64 ft., leaving an effective head of 256.36 ft.

Chinese Road-Making.

A CORRESPONDENT of *Indian Engineering* thus describes the roads about Hong Kong, or at least the best of them: The wearing surface is 6 in. thick, made mainly of granite broken to the size of walnuts and laid on a foundation of rough stone. In making this road, sand and lime is first thoroughly mixed in a box 15 ft. sq. by 1 ft. deep; the broken stone is then added and also well mixed. When a sufficient quantity is thus prepared to cover a space 100×30 ft. it is spread out quickly and rolled by a granite roller weighing about 4 tons pulled about by 150 men and women. This rolling is continued for 4 or 5 days, the only water added being sprinkled over the roller at intervals to keep it clean. In 5 days the road is perfectly hard and smooth. It should be mentioned that there is no horse traffic over these roads and the only wheeled vehicles are the *jinrickshaws* of the natives.

THE tests of the new direct process steel which we noted last week (made directly from the ore, without any intermediate conversion into cast or wrought iron whatever), resulted in a very marked success. The large members showed as good tests as previously tested small members, as we note more fully elsewhere, and in every way the indications are that a very great and a very important addition to our metallurgical process has been made, which may work something very like a revolution in the manufacture of steel.



Ground Plans of Some of the Great Masonry Dams of the World.

From the Reports of Chief Engineer A. S. CHURCH, and Consulting Engineer A. FTELEY, to the new Croton Aqueduct Commission, New York City.

ENGINEERING NEWS

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D. McN. STAUFFER. A. M. WELLINGTON.
EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

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FROM details shown to us by Mr. G. H. THOMSON, bridge engineer of the New York Central & Hudson River Railroad, who has carefully studied the details of the "new process open hearth steel," we learn that the Athens tests on eye-bars to which we alluded last week, have more than justified the hope that the remarkably favorable showing which the material has made in small specimens would be justified by results with larger pieces. The full sized bars, in fact, showed better results than the many tests of small pieces, while the fractures were phenomenally fine, a result the significance of which will be generally appreciated by engineers. The tests were regarded as highly satisfactory by all who witnessed them, and had various new and interesting features besides those noted, as we shall show more fully in a later issue.

The superior quality of steel made by this "new process" is due principally to graphite used in the reduction of the ore, the process leaving a sponge of virgin iron which, being protected from oxidation, can be readily manipulated. The time *from ore to ingot* is only 3 hours, 35 minutes, and the iron is not brought to a melted state but once in the whole operation from ore to steel, with the result that the life is not burned (or "boiled" out of it. The bars tested were poured from the top of a small improvised one ton furnace, yet gave fine results far in excess of any existing specification requirements as to ductility, reduction of area, etc. The steel is very uniform, low in phosphorus, and more ductile than iron, and forges with much more ease, we are assured. The advent of this new steel, it is clear, may possibly cause important changes in bridge practice, if the prices are to be as low as its promoters promise. We feel compelled from sad experience to take all such roseate allegations with many grains of allowance, and obstacles as yet unforeseen or unrevealed may yet become clear, but certainly the new year opens with a very fair promise of an important addition to our meteorological resources.

THE immediate cause of the dangerous oblique collision on the Third Ave. elevated line, which came so near knocking a car or train into the street, is a removable one, having an open track connection between the stub track to the ferry and the main line. By using the Shaw friction buffers, or some equivalent device, this connection can be effectually closed in all working hours, and yet be readily opened at times when a locomotive or car is to go into or out of service. The same possible danger exists at 42d. st., and both these points should be protected in this way, since it is an idle hope that human vigilance alone can ever be trusted to avert such dangers. It is easy to say after the event that it only came from carelessness in the engineer, and in a sense it is true, but in another sense it is not true, since experience long since showed that human vigilance alone is not equal to the strain of performing routine duties, always well and exactly. The incident illustrates the extreme importance of avoiding all possible chances for collisions, and especially oblique collisions, on rapid transit lines, on which we have had frequent occasion to insist.

Besides this direct moral, this accident and the one at almost the same time on the Brooklyn bridge, lend additional probability to the prediction in our last issue, that "we fear it is only a question of time, when there will be financial as well as humanitarian reasons, for wishing this [radical enlargement of facilities] had been done in time, rather than tempt Providence by crowding facilities whose reasonable capacity was long since outgrown." The indirect cause of both these catastrophes was the rush and hurry with which the handling of trains is necessarily carried on in order to keep them out of the way of each other. The precise form of accident which will result from this general cause can never be predicted in advance. Sometimes it will be one thing, sometimes another, but the accidents must needs come. Vigilant and skillful management, combined with the quick intelligence of a whole staff of employés, can accomplish and has accomplished marvels, but it cannot work any such miracle as to never crack pitchers which are lowered every few seconds into a well too small to hold so many of them.

The burnt child dreads the fire, as a general rule, but the same rule does not always hold with grown people, and certainly not with railroad officers. Nearly everyone will remember or be able to recall the terrible Tehachapi accident of some four or five years ago, on the Southern Pacific Railway, in which nearly all of a trainload of people were killed or injured by the derailment of a runaway train which could not be stopped because it had not automatic brakes. One would have thought that such a lesson would have led to the invariable use of the automatic brake thereafter, as the pressure retaining valve, by which a certain minimum pressure is kept in the cylinders at all times in descending a grade, does away completely with the old excuse for using "straight air." "Straight air" is still used there, however, as a subscriber who has just come over the road informs us, and the very train that he was on broke in two twice on the grade, although without any disastrous results, since the trainmen were awake and on the watch. Thus hard is it to get the most ordinary and simple precautions adopted when past routine resists them.

THE grave disaster resulting last week from a confusion of the words Somerset and Summit, should not be lightly passed over, for it is a danger which is liable to occur on any line where adjacent stations on the same division have names at all resembling each other. It suggests, first, that all names of stations which may possibly be confused with others should be changed, and secondly, that as an additional precaution the telegraphic call for each station may well be added to the name of the station in full. All railroad employes become very familiar with these calls, so that Xd suggests Cleveland or Zm. Chicago, even more surely than the name written out. The last should on no account be omitted, but to give both in all train orders would be a very simple and very wise precaution; while this accident still more clearly indicates that the names of all stations on the same division should be critically compared with each other, especially on new roads, to avoid the possibility of confusion. It is to be remembered, that train orders are both written and read hastily, by comparatively illiterate men, often in a poor light, and that they are manifolded on thin tissue paper in very coarse lines. Under these circumstances it was a very easy error to mistake a hastily written Summit for Somerset. Either may be easily written with a blunt pencil to look more like the other than itself; the letters S-m-t are common, and there are the same number of intermediate cusps of other letters to make over into anything which will suit previous expectations; for everyone can see how easy it is to write *o* like *u*, *e r s* like *m* and *e* like *i*.

The incident should lead to a thorough overhauling of the names of stations throughout the United States, and we trust the railroad papers and press generally will call attention to the matter.

WE are pleased to write that there is strong and increasing opposition to further occupation of the City Hall park for public buildings of any kind. Several of the daily journals have expressed themselves strongly on this matter in recent issues and the danger that there would be an attempt to combine the City Hall, Court House, and two other new buildings harmonious with neither into a single nondescript structure, which could not help being a disgrace to our artistic civilization, is at least almost over. The project of adding two wings to the City Hall only, while raising the latter a story or two has far less about it that is inherently offensive while affording precisely the same additional space. The strong objection to even this course, however, is that the City Hall building and the City Hall park are creditable relics of old New York, and the small remaining amount of green space in the latter is no more than the public health and comfort demands, while it is by no means essential that all the city officials should be housed in the same building or in any building connected with the City Hall. Suitable property in the immediate vicinity can be reasonably purchased to house the bulk of the city officials, and will be quite as dignified accommodations as their character or the nature of their work demands, especially as there is no probability that sufficient room would be provided to answer the demands of even a decade or two ahead, even in the buildings proposed.

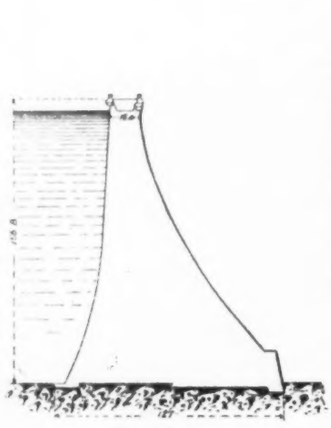
IT is to be remembered that down-town New York shows a permanent and increasing tendency to grow upward toward the sky and that the whole City Hall park will ere long, be surrounded by very high buildings. It is also a great thoroughfare for foot-passengers to the elevated lines and Brooklyn, bridge as well as to a possible future underground line. The Brooklyn bridge alone will ere long be pouring six or eight times as many people over and through it as now, and a new Elm St. underground line would add still more to the throng. There is, therefore, no real justification for crowding the Park with further buildings merely to save ground rent elsewhere. It would be far wiser and in better taste to let both park and building stay as they are, the sole remaining reminder of the days when New York was a small Dutch village, or so small a city that the upper side of

THE GREAT MASONRY DAMS

Drawn to uniform Scale.

Taken from the Reports of Chief Engineer B. S. Church, *and Consulting Engineer* A. Fteley.

Further details as to dimensions and location of these dams are



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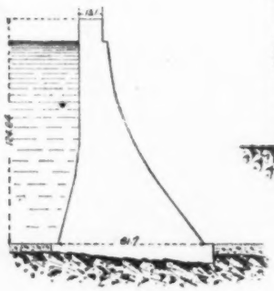

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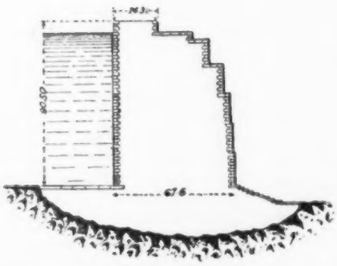

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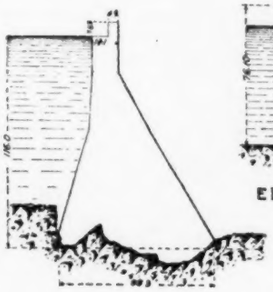

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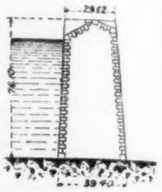

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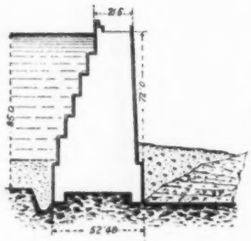
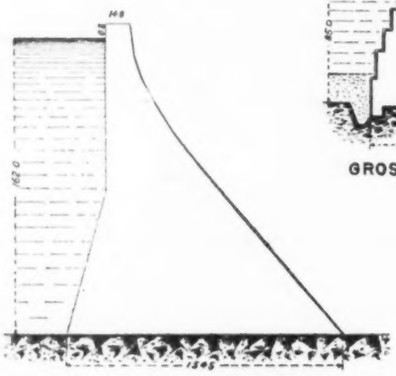


GROS-BOIS

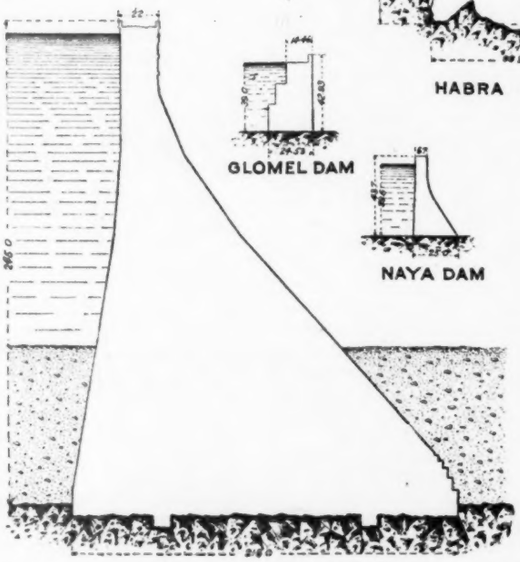
GLOMEL DAM

VIOREAU DAM

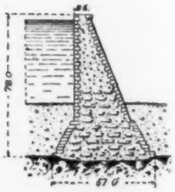
NAYA DAM



VILLAR DAM



QUAKER BRIDGE DAM



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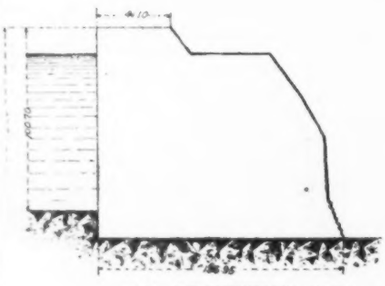

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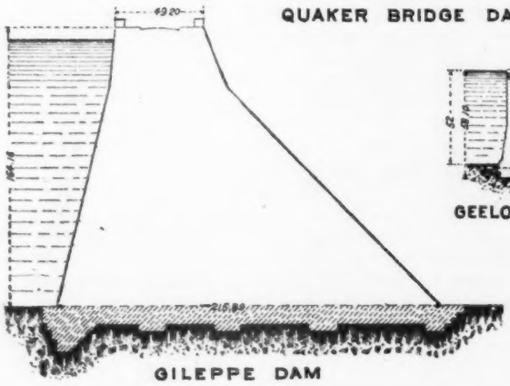

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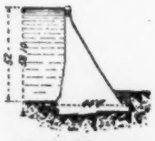

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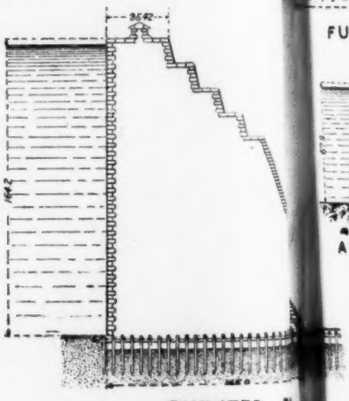

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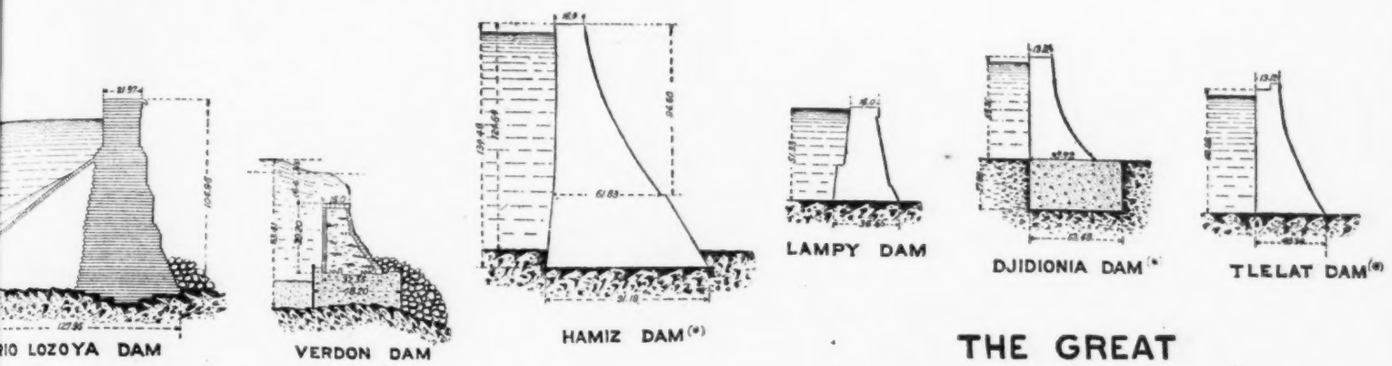
AMS OF THE WORLD.

rm Scale.

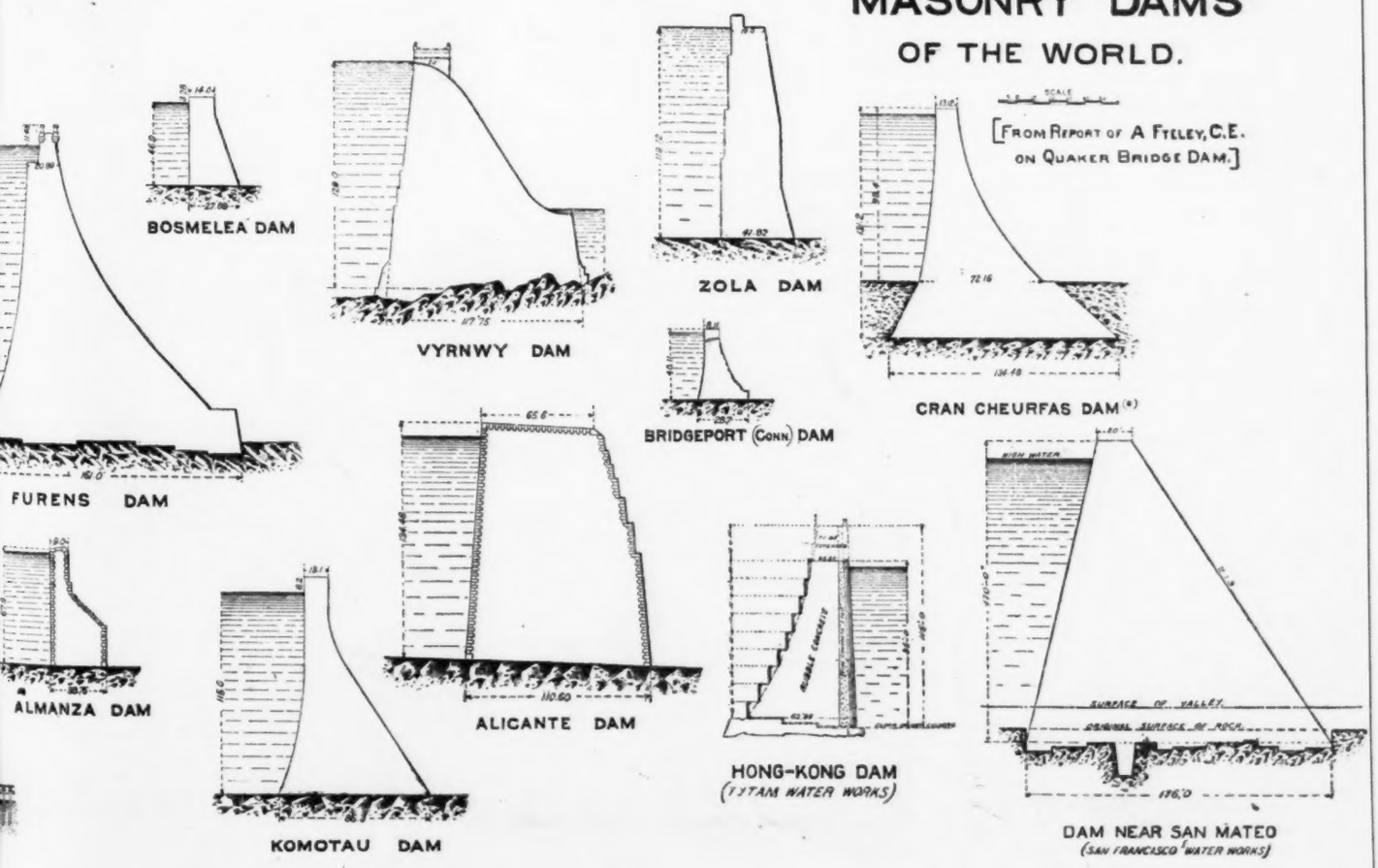
A. Fteley *to the New Croton Aqueduct Commission, for the City of New York.*

se dams are given in a table in this issue.



THE GREAT MASONRY DAMS OF THE WORLD.

[From Report of A Fteley, C.E. on Quaker Bridge Dam.]



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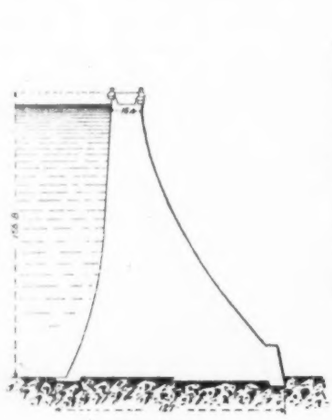

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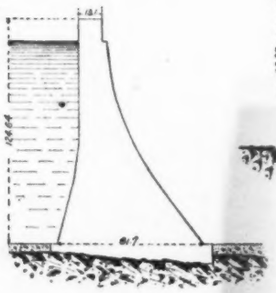

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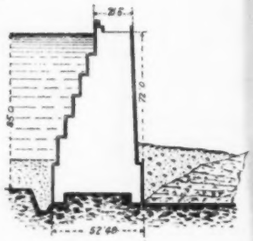

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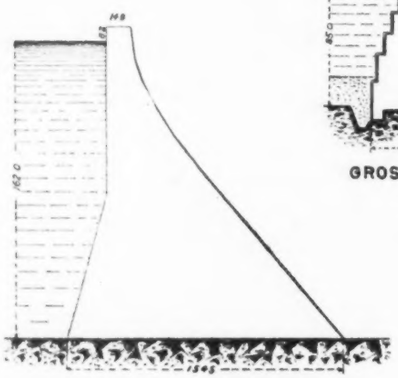

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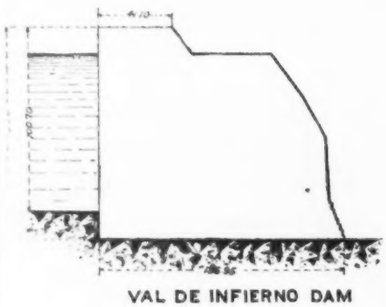

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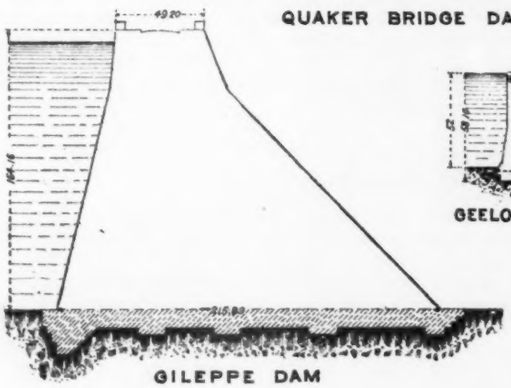

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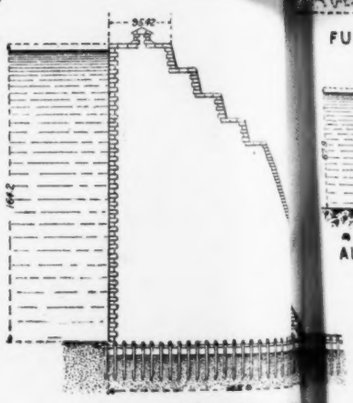

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A. Fteley *to the New Croton Aqueduct Commission, for the City of New York.*

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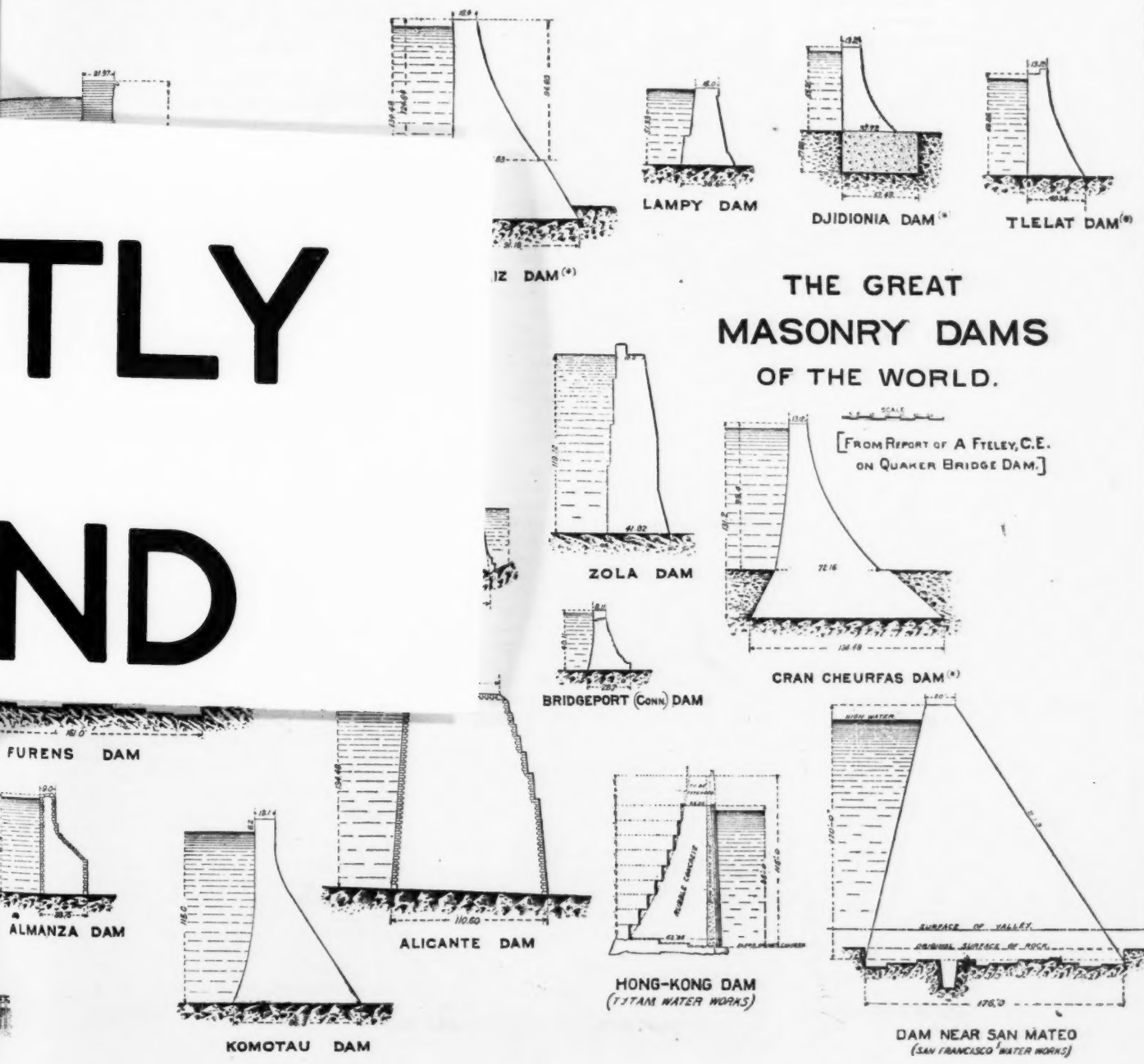

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the City Hall was built of a poor red sandstone, "since it was not likely that the city would ever extend much above it." Sentimental reasons alone might be a poor argument in such a matter, we admit, except that the public health and convenience favors the same course.

THE Argentine Republic appears to offer an encouraging field just now for unemployed labor in connection with its enormous activity in railroad building. In 1886 alone the sum of $290,000,000, bearing a government guarantee, and $60,000,000 more without such guarantee were authorized to be expended upon rail roads in the Argentine Republic. At $35,000 per mile this means 10,000 miles of new railway, says the English *Railway News*, and the same journal figures out a corresponding demand for 500 stations, 2,000 locomotives and a proportionate number of cars for passengers and freight. The *News* gives the average wages paid in the republic as follows:—Engine drivers, first class, $85 per month; second class, $50; conductors, $65 to $75 per month; telegraph clerks, $45; carpenters, $1.75 to $2.25 per day; blacksmiths, $1.75 to $2.75; brick layers $2.25 to $2.75 and laborers 75 cents to $1.25 per day.

While the sum total of the above appropriation is startling as coming from a comparatively new government and people, there is no doubt of the wonderful activity and enterprise that now pervades this Yankee-land of South America. The zone including the Argentine Republic and Chili corresponds in climate to that occupied by the United States, and the geographical situation has doubtless much to do with the progress that is here apparent among the children of the Spaniards, and the contrast between their advance and the slowness of their fellow countrymen in the more torrid sections of South America is as sharp as the difference in climate.

The one thing to be regretted is that, as the people of the Argentine Republic are not yet producers of the many things they want to bring about the contemplated improvements, the United States has so little to do in their supply. English engineers and material and English capital above all else are the factors in this advance; and Germany and other Continental nations are ahead of us. Our capitalists are to blame in this matter and not the Argentine Republic, for the latter has invited our capital and held out all inducements in vain. The position taken that our own country is too new and great and its demands too many to permit outside enterprise, is hardly tenable. The Englishmen invest capital in foreign lands with the full purpose of obtaining goodly returns, and while the investors are sometimes deceived, the enterprise more frequently pays them. We too have abundant capital, and by very reason of our own great and recent works have decided advantages over other nations in trained constructors and unexcelled engineering plant. If other nations can make money with inferior plant and by comparatively wasteful methods, in building on the lines laid down under other and very different conditions, Americans should make more money and furnish at the same time work better adapted to the needs of a country very much like our own. These remarks particularly apply to the present work in the Argentine Republic, and under a different reception of the invitation extended to us some years ago, our manufacturers and railroad builders might have a very much enhanced interest in the great improvements now going on in that section.

WE learn with no common pleasure that the New York Central & Hudson River Railroad is taking the lead in a movement which should become universal, by actively beginning the policy of flooring over with solid iron floors, all its small bridges and track openings, (from about 100 ft. or more down) and carrying its ballast directly over them, so that the continuity of the road bed is interrupted only by a few large structures, constituting on most roads less than one-tenth or one-eighth of the total *number* of openings, and the number of such, much more than their total length, is the important factor.

From every point of view, nothing less than this should be regarded as good engineering on any first class road provided with permanent structures, or those designed to be such. On the ground of safety alone it is obviously a decided advantage, which can hardly be obtained so well by any form of timber floor, and certainly is not obtained by any common form of floor. As respects durability of iron work, it is very clear that it will be a decided advantage, by its addition to the dead weight of the bridge. In any short span bridge the strictly necessary dead weight to make the structure safe for a time, bears so small a ratio to the live load, that the vibrations must in the nature of the case be excessive, and the resulting deterioration unduly great, so that there is in every such case a positive addition to *permanent* safety from placing this additional dead load upon the bridge. The only possible arguments on the other side are, first, the extra first cost, which is not great enough to be entitled to much weight, and secondly, the alleged tendency of the iron floor to rust under the ballast, which is a danger easily guarded against, and which experience has shown to be not a serious matter.

AT a late meeting of the Royal Statistical Society, in London, Sir JULAND DANVERS, the Public Works Secretary of the India Office, pointed out in a paper read, the "Defects of English Railway Statistics." He made the point that the present English returns of total passengers and tons transported are of literally no value to those interested in the efficient and economical management of railways; but that these returns should show in detail the distances, or the total unit mileage of passengers and merchandise, and many other details. Sir J. DANVERS said that this detail was given in colonial and continental railway returns, but was most complete in American railway statistics.

The speaker then proceeded to show the bad and insufficient features of the present system and the effect upon the public of certain restrictions to trade and favoritism to foreign producers, concealed under the irresponsible and obscure returns of railway companies. The remedy suggested, was practically the full adoption of the American system of returns.

It is amazing that all this should need pointing out in 1887. The English reports are now inferior to those of any other civilized nation.

Our Highways.

The Engineeering Department of the Vanderbilt University, of Nashville, Tenn., has, under Prof. OLIN H. LANDRETH, inaugurated a most commendable course of instruction, and a novel course in so much as it is free of charge to the student.

This is a special course of instruction in the science of road making and maintenance. To it are admitted free of charge, one principal or deputy highway commissioner or other official from each County in Tennessee; the appointment is to be made by the County Judge and must set forth that the candidate is officially connected with the public road system of the County wherein he resides. If no applicant applies from any one County, the Judge has the privilege of appointing one similarly qualified, from any County of any State. The course extends from February 1 to April 1, and will consist of lectures and work on the economical location of highways; principles of construction of new and re-construction of old roads; maintenance, repairs, drainage, simple highway structures, etc.

In the lack of almost literally all previous training or knowledge in the men now in charge of our public highways, this new departure may do some good, and we heartily wish it success. But while the University is to be commended for the step it has taken and the opportunities it presents, the difficulty will lie in the acceptance of this invitation by the road masters themselves, and in the value of a two-months'course of instruction to those who most probably lack the very rudimentary parts of what should really be a profession.

The proper construction and maintenance of the enormous highway mileage of the United States demands more than this, both in the schools and out of it. We must first have wisely framed laws that will introduce some system and responsibility into this matter; and not leave it, as now, in the hands of private citizens, locally and temporarily appointed and without the technical training required or an appreciation of the value of such training. Under the present system, any farmer or mechanic is eligible for appointment as a superintendent of roads, some wordy but meaningless laws to the contrary notwithstanding. He only fills the place until some other party in power supplants him; and it is not to be wondered at that he takes little interest in his duties, and practically leaves the detail to local bosses still more ignorant of actual requirements than himself. With these parties "economy" usually means bad work, that in effect makes bad roads worse, and practically puts an end to general traffic through certain seasons of the year.

Good country roads are as essential to internal traffic and public comfort, as are well paved streets in a city. They are constantly in use as ways of communication, and the fact that, as a rule, our main highways are in a worse condition now than before the railway era was inaugurated, is simply because whereas they were once cared for by the turnpike companies that were held to a certain accountability by the travelling public, they are now in the hands of those practically responsible to no one. For, no matter how rough or impassable a road may be at present, nor how much a really good road might benefit him, the farmer who now controls, is loth to tax himself in labor or money for their proper maintenance, and never will until he must.

The country authorities must first be taught what good roads mean, and here comes in the good work of the Vanderbilt University, if the authorities will only take advantage of the opportunities. Once the real benefits are apparent, the more enlightened of the farmers will themselves demand compulsory improvement on the slip-shod methods of today; and with system established, responsibility fixed, means provided, and a reasonable and equitable continuance in office secured, we can look for men who will make a business, or profession of the art of all that pertains to good country road making. And when that day comes we will find more schools following the example of Prof. LANDRETH, and the course expanded to years instead of months.

On the Continent of Europe and in England the construction and proper maintenance of highways is a State affair; their superintend-

ence is recognized as an important and responsible duty and we usually find them in charge of specially trained, expert government engineers. The result is magnificent roads, of a degree of excellence of which we Americans have no conception, because outside of mere pleasure drives they nowhere exist with us. Our roads are too many and too long, and the tax would be too great upon our people to at once demand even a distant approach to Continental highways in point of construction and maintenance. But we are growing richer every day—*are* in fact the richest nation on the face of the earth—and it is high time that we made a beginning at least, in the improvement of our highways. They are probably the one thing most neglected in our rapid advance in almost every other direction. And as we are daily adding to our list of luxuries, if good roads must be classed among these, let us have them.

But the law makers must take the initiative step in each State and evolve a system that can be carried out without unduly burdening the community and yet be productive of good results. The law must be made to be obeyed; and the agents of the law must be trained officials, holding office during good behavior, appointed under proper tests and restrictions, and held to a strict responsibility for their work. Then and only then, distant as the day may be, can we first secure and then maintain the type of highway our national importance, wealth and self respect even now demands.

Turning Over A New Leaf.

The time of the year has come when most men turn their thoughts for a time at least to taking what might be called a mental account of stock, or perhaps it might be better said, a mental observation of their position as compared with a year or ten years ago, to see how far they have advanced beyond where they were then, or how far they have been driven back by unfriendly weather, and what course they had better steer hereafter. It may be somewhat absurd to choose one time of year more than another for doing so, but, wise or foolish, it is natural, and the great bulk of men do it, more or less consciously.

And no doubt to a large majority the result is a disappointing one. Many have made no advance at all, but are worse off than they were a year ago. More have merely stood still, and perhaps for many years, when they feel that they might and ought to have made a good deal of progress. Others again have gained a little but have still had to see others pass them whom they felt to be less deserving than themselves, so that relatively they feel as if they were going backward. To the few only, is it given to look back upon the past with a decided excess of satisfaction and contentment, and perhaps to them only for transient or unworthy motives. The great bulk of all classes of men, those only excepted who are tending to sink into a vegetable condition, look back upon the past with more or less dissatisfaction, and look forward to the future with more of less anxiety and doubt.

It is well that this should be so. Contentment may be defined as at once the greatest and the meanest of human virtues. In its broadest and highest sense when it leads a man simply "*Having done all*, to stand," content with the result, it is certainly a chief factor in making a man's existence endurable to himself and to others, but in another and perhaps more common sense, it is certainly one of the lowest and meanest of human qualities, as its opposite is one of the noblest and most necessary. One of the most radical distinctions between man and the brutes, in fact, and between the higher types and lower types of men, is that the last are chronically contented and the first are chronically discontented, let happen what may.

Civilization would soon cease were this not so, in material, mental and moral things alike, and therefore it is fortunate that in this country at least, no such alarming result need be feared. Professional and material contentment, at least, with which alone it is our proper function to deal, will never be disastrously common here. On the contrary, it is the vice of our age and country to be anxious overmuch for success in such matters, and as the average American is never thoroughly contented if he sees any one ahead of him in any respect, and as in the nature of things there can be only a very few who can even imagine that there is no one ahead of them in several respects, and still fewer who can imagine so with truth, the New Year reflections of practically all mankind, who reflect at all, must be tinged with a feeling of more or less disapointment, and largely made up of efforts to detect the causes therefor in their character and past actions, and how best they can correct them hereafter.

This can rarely indeed have any other than a good effect on any one, especially as there is rarely much reason for any absolute discontent, in this country at least, and cartainly not among our own readers. "Experience keeps a dear school, but fools will learn in no other," and most of us are fools to this extent, that our most valued and most profitable lessons have come from experience. Few men are fortunate throughout their lives, and those are rather to be envied than pitied whose misfortunes or disapointments come early in life, and who are thus led, while there is yet time, to "turn over a new leaf," and by perceiving and avoiding the causes therefor, to profit greatly in the end by their own set-backs.

It would greatly help every one to "turn over a new leaf" profitably, if he would give up that fool's paradise in which so many live, belief in "luck" as a factor to help them forward or as a cause for their going backward. Properly speaking, there is no such thing as luck, although in another sense, every thing is luck. Opportunities go floating by every man throughout his life, like apples in a stream. Some he nurses, because he cannot swim, some he barely fails to grasp, some he grasps but cannot hold, some come almost into his mouth whether he will or no. Every man is surrounded by opportunities, now more and now less, but always with some within sight. As with a crowd upon the street, the meeting of each individual one may be said to be pure luck, but in meeting the crowd as a whole, whether of men or opportunities, there is no element of luck whatever; for every man's life is a kind of "walking down Broadway" for the luck it brings within his grasp. What particular "streak" of luck he will hold fast to can alone be regarded as largely chance. That each will have about as large an assortment to choose from, if he will, is not at all a matter of chance.

Why then do men avail themselves in such unequal degree of these streaks of "luck"? Largely, no doubt, it is from difference in inherited capacity or early training, but in the main it is from differences in that form of genius which is better known as hard work. In other words, the luck comes to, or goes by a man, almost in a moment, but whether he profits by it or not depends chiefly, not upon what he does at the moment, but upon what he has been doing for the past ten or twenty years. Who are the "lucky fellows" that each of us knows? Are they not to a man hard-working, studious, faithful, interested in their work for its own sake rather than for what they can make out of it, doing with their might whatsoever their hands find to do? In part indeed—for it would be idle to deny that bad as well as worthy traits sometimes help to success—it may be from meaner qualities. Lying, niggardly time-serving, back-biting and other despicable traits sometimes help a man greatly, for a time at least, although rarely for very long or very far, but whatever it may be, there is no *luck* about it; for it is nothing more than a structure reared on a laboriously laid foundation, which it has taken years to build. The conditions of life are such that we have to lay our foundations somewhat at random, and devote a good deal of work to them which we are not sure will tell directly, since we cannot foresee the precise length and breadth and depth of the structure which it will be our "luck" to rear upon it. Perhaps it will never be much of a structure at all, as it certainly will not be if there is no previously laid foundation, but those who have laid a foundation broad enongh and deep enough for any structure will be very likely to be able to put any structure they please upon it, by choice from their various "streaks of luck."

In part we all recognize these truths in the usual crop of New Year resolves to "turn over a new leaf" by correcting some of our past deficiencies, if it be only by resolving to no longer do without the weekly organ of our profession, which our books show to be one very common form of "turning over a new leaf" at New Year, since our subscriptions at that season are always disproportionately great, but we can wish our readers no better fortune than to fully realize that, with very rare exceptions, they have only to *look within themselves* for all the reasons of their relative non-success, with the natural resulting conclusion that they will "turn over a new leaf" in respect to them. It may be only some little trait, some odious trick of manner, some offensive form of egotism, like eating with one's knife, wearing dirty collars, constantly treading on other people's toes, over-confidence in assertions, or what not, which is easily corrected. It may even in cases be some trait which ought not to be corrected, like sturdy uprightness or resistance to overbearing or insulting oppression or petty meannesses; although these are more often imagined than real causes, and at the worst stand only temporarily in one's way. But whether it be one thing or another, *a cause* for every set-back can always be found within one's self, and half the battle of life is won when it has once been learned to read these causes truly, without silly self-conceit, or without throwing the blame where it never truly belongs for very long, upon mere chance. The end is not sensibly affected by chance, because every man has luck which he can profit by, at frequent intervals, if he is fitted to do so.

At least a reasonable degree of comfort and success is assured to every man who will turn over his new leaf as we suggest. No amount of study or fidelity can entirely neutralize the effect of the great and enduring differences in the natural capabilities of men, so that the fortunes of men can never be alike very closely, let them do what they will. But as a high grade of faithfulness and of industry are in even greater demand than a high grade of ability, of which indeed they are the larger factors, and as these gifts are within the reach of every man who chooses to have them, they alone will assure him of a degree of success of every kind which should suffice for reasonable ambition, and make each successive year a happy one. On the other hand, the ruin of thousands of men is drifting along with the tide and doing nothing to either command success or deserve it, except to draw their pay

while they can with punctual regularity. All such will do well to "turn over a new leaf" without delay, and keep it over. In time they will no longer be able to.

The Poughkeepsie Bridge.

ON Friday, December 30, a number of engineers, by invitation of the Union Bridge Company, visited the Poughkeepsie Bridge, the occasion being the connection of the center panel of the suspended truss of the west cantilever span. Owing to the extreme cold of the several previous days the connection was not quite completed, but the ends of the travellers on the two arms of the cantilever were within 40 ft. of each other before the party left and the connection was made on the following day. The superstructure as erected now stands thus: shore-arm and west cantilever span, 749 ft., west connecting span, 525 ft., and shore-arm of east cantilever 201 ft.; total, 1,475 ft. There is still to be erected the east connecting span of 525 ft., and the center and east cantilever spans of 546 ft. and 548 ft. respectively, a total of 1,619 ft. This is exclusive of the long trestle and viaduct approaches at either end of the structure, much of which will probably be erected this winter. The visiting engineers examined with much interest the very complete appliances devised by the Messrs. BAIRD for the erection of the trusses. The travellers used are doubtless the most complete pieces of plant ever built for a similar purpose. They are like those employed at the Niagara Cantilever bridge in general design, but are more massive, being practically a pair of moveable 150 ft. spans of double-track bridge. This traveller is self-propelling, and by a unique and admirable hoisting engine (built by J. S. Mundy, of Newark, N. J., from designs by Mr. BAIRD), handles six falls at one time and also propels itself when necessary on a special track; the engine is 16 H. P. As the top chord of this bridge is 212 ft. above the water and the top of the traveller about 30 ft. above that, as much as 3,000 lin. ft. of rope are required for a single fall. And as the number of falls required for hoisting and handling material and swinging working platforms and propelling the travellers, etc., is necessarily very great, it is not remarkable that the total rope about the two travellers is measured by miles. The erecting plant, the colossal proportions of the bridge itself, the admirable arrangement of the material yard, etc., were critically examined and approved by the following engineers and their friends:—Messrs. T. C. CLARKE, Gen. FIELD, Chf. Eng. J. F. O'ROURKE, Mr. ESCOBAR, of the Union Bridge Co., Chf. Eng. P. P. DICKINSON, of the Poughkeepsie Bridge Co., and Chf. Eng. A. B. PAINE, of the Manhattan Bridge Co., acted as hosts and guides to Messrs. CHURCH, HUTTON, BOGART, HAMILTON, CROES and STAUFFER, of the American Society of Civil Engineers, and to Mr. BROCK, President, and Messrs. FLETCHER, NETTLETON and other capitalists and railroad men interested in the structure. Despite the nipping air and the steep and slippery climb from the river to the bridge floor, the work of inspection well repaid all who accepted the courtesies of the Union Bridge Company on this occasion.

CORRESPONDENCE.

Japanese Bricklayers.

KANSAS CITY, Mo., Dec. 22, 1887.

EDITOR ENGINEERING NEWS:

Bricklayers of Japan understand their business pretty well, but they have never had any experience in American methods of bricklaying. There are many who have the desire of coming over to this country to get this practice. Of course, one can't expect them to speak English, but they are able to lay more than a thousand bricks a day, provided that the work is not very complex. They are not accustomed to do work several hundred feet up, but a few months will make them do it. They can come to this country at their own expense, but they must soon be employed. I wish to know if there would be any good chance for them. Hoping that you will kindly inform me, Yours truly,

K. KOBOYASHI.

[We fear they would have a poor chance unless they could lay more than a thousand bricks a day, and the trades unions might make them trouble. A few might do well.—ED. ENG. NEWS].

Field Work of Railway Location.

DEGO, KANAWHA CO., W. Va.
Dec. 28th, 1887.

EDITOR ENGINEERING NEWS:

I wrote you June 24 last to know when Mr. WELLINGTON'S "Field Work of Railway Location" would be ready. You answered that you hoped within a year but that you promised nothing—that the more novel parts would propably appear in advance in ENGINEERING NEWS. What I am particularly interested in is the subject of "transition curves." If this portion of the book is yet in print, either in ENGINEERING NEWS or elsewhere, please inform me where and for what price I can obtain it.

I hope the the Field-Book will give full and accurate tables of cost of various styles of wooden and iron trestles and bridges, masonry, etc., for various heights and spans. Yours truly ,O.A.V.

[Neither portion of the Field-Book as to which our correspondent inquires is as yet in print, but as we have received several inquiries of the same nature as to the particular question of transition curves, we may say that we hope to publish that particular fraction of the work at an early date. Such "full and accurate tables" as our correspondent speaks of for "various styles of wooden and iron trestles, bridges, masonry, etc." would hardly belong in a book for field use however, and will not be contained in it. They would more properly belong in a large illustrated treatise on construction details, designed for office use only,—a book which does not as yet exist but which certainly ought to.—ED. ENG. NEWS.]

Bridge Piers in Water Power Canals.

COLUMBIA, S. C., Dec. 30, 1887.

EDITOR ENGINEERING NEWS:

A certain railroad wishes to cross a canal of the following dimensions, now under construction and *designed for water power only*:

Bottom width		150 ft.
Water line width		195 "
Depth water		10 "
Bridge spans, 2 of		125 " each.
Width of pier	bottom	8 " 4 in.
	water line	6 " 8 "
	top	5 " 0 "

The engineer of the railroad decided that the most economical bridge would be two uniform spans of 125 ft. This would require him, however, to put one pier in the canal, which the engineer of the canal refused to allow, on the ground that it would *diminish the available water power*. The point is two miles below the head of the canal and a half-mile above the first mill site. The engineer of the railroad claims that by widening the canal at and near this point so as to still leave the maximum cross section, that the diminution of water power will not be appreciable, if any. The question of navigation is not raised, but it is readily seen from the described dimensions that it is not affected either, as ample space is left for any ordinary canal boat; and if steamers are ever used here, it will be necessary to build a pier in the canal to support a draw bridge. I would like to have an expression of opinion.

W.

[The position of the canal engineer is not defensible. The degree of its weakness depends somewhat on the strength of the current, but water power canals are not usually allowed to have a very swift current, and in any current the loss of 75 sq. ft. *at one point only*, out of a total cross-section of 1,725 ft., is inconsiderable, since it is fully made good by an addition of 5 per cent. to the speed of the current at that point. The loss of head to give this added speed is too trifling for consideration, apart from the ease with which the normal cross-section can be maintained by enlargement.—ED. ENG. NEWS.]

Unsymmetrical Sections.

Chief Eng. Office, Pittsburg, Cin. & St. Louis R. R.
COLUMBUS, O. Dec. 28, 1887.

EDITOR ENGINEERING NEWS:

I regret to learn from your issue of Dec. 17, that Prof. A. J. DUBOIS, having been once right, has gone wrong; and not only expunged the foot note which placed him in advance of his fellows, but has taken up the cudgels in defence of error.

He must have read my communications in the NEWS very carelessly or he could not have so grossly misapprehended the point at issue.

I agree with him on the theory of plane sections after flexure. I agree with him, that the elongations and contractions of the several fibers are proportional to their distances from the neutral axis. I agree with him that the fiber forces are also proportional to their distances from the neutral axis.

But I deny his "second condition," that "equilibrium can only exist when the sum of all the fiber forces above the axis is equal to the sum of all below."

There are two distinct classes of conditions affecting the question of equilibrium.

First. Equilibrium can exist from *equality of forces*, only when the opposing forces lie in one and the same straight line, or are so arranged about common centers that their resultants lie in one and the same straight line. (In the latter case the resultants must be equal, though the actual forces need not be).

Second. When *parallel* forces act at different distances from a common center, or axis, equilibrium *can not* result from *equality of forces*, but is only possible when the *moments* of these forces are equal. The simple lever is a familiar illustration of this.

Prof. DuBois and the text-books, when they make the resistance of a beam proportional to the *moment* of inertia, treat the fibre forces as being of the *second* class. But they insist on treating them as of the *first* class, when they seek to find the neutral axis of the section.

I insist these forces are of the second class, and must be so regarded for *both* purposes.

This is the only point at issue and is the whole gist of the controversy. Hence the Professor's learned dissertation on "curved sections" and the "moment of the moment of inertia," is a useless waste of *vital* forces producing neither "equilibrium" nor "motion."

The Professor's "second condition" is equally false statics whether applied to symmetrical or unsymmetrical sections. In the former it does not lead to erroneous results, because the line which equates the *forces*, and the line which equates *their moments* are coincident. In the latter, it does lead to error because these lines are *not* coincident.

For beams under transverse loads, the resulting error is relatively small; but in locating the pin centers of compression members in bridges, the error becomes too important to be neglected.

The Professor asserts that his position checks with experiment, and mine does not. The Pencoyd book states that the author found from experiments on beams of symmetrical section that the Modulus of Rupture for iron is 42,000; and that the experiments on **T**s and **L**s, of equal legs, required this Modulus to be increased to 45,000 if I is taken about the axis through the center of gravity; but if I is taken about the axis which equates the moments of inertia, then the same value of the Modulus applies to symmetrical and to unsymmetrical sections alike.

Now as the entire influence of the form of section is embraced in the I of the formula, and the influence of the physical properties of the material is wholly embraced in the Modulus, it follows that if a separate modulus is required for each shape, to make the experiments agree with the Professor's theory, then that theory must be wrong. These experiments therefore disprove the Professor's position and confirm mine.

The Watertown experiments on columns cited by me, show that top-chord sections, of the proportions there used, and with the pins at the center of gravity of the section, have 20 per cent. *less* strength than they would be accredited with by formula, and they deflect in a direction due to leverage above the axis.

My theory checks with these experiments also, and the Professor's does not.

All top chord sections will not show the same loss of strength as those tested at Watertown. The larger the area of the cover plate relative to that of the channels, the greater will be the eccentricity of pin centers, and consequent loss of strength, if the text-books are followed. It therefore behooves bridge builders and bridge buyers, to look well to this matter. They cannot afford to endanger life and property by following erroneous teachings, even though supported by the great names of the profession. THOS. H. JOHNSON.

["The quarrel is a very pretty quarrel as it stands, and we should only spoil it by trying to explain it", or we may add, by trying to go to the bottom of it; but as some doubt has been expressed as to "which Mr. JOHNSON we were backing" in a former note, we may add that it was *Mr.* JOHNSON, the above writer, and not his antagonist *Prof.* JOHNSON. In saying this we avail ourselves of the advice of an old and wary engineer, to this effect: In writing opinions, give your conclusions, but not your reasons for them. Your conclusions may be all right while your reasons are all wrong". We do this because their must be some real obscurity and doubt somewhere, or such competent men would not differ, but we confess we fail to see where it is. ED. ENG. NEWS.]

PERSONAL.

EDWARD BRUESTLEIN, formerly of New York, is the Engineer-in-Charge of the Birsigthal road in Switzerland.

M. ROBERT BARRY, late Superintendent of the Central division of the Pullman Car Service, has been made General Inspector of the Pullman system.

JOHN B. RILEY, late Indian School Superintendent, has been appointed Chief Examiner of the New York Civil Service Board.

WM. M. S. DUNN has been appointed Consulting Engineer of the Chesapeake & Ohio R. R., with office at Richmond, Va.

Gen. ADNA ANDERSON will on Jan. 1, according to the press accounts, terminate his connections with he Northern Pacific R. R. as 2nd Vice President and Chief Engineer. He will then assume the position of Vice President of the Buffalo, Rochester & Pittsburg R. R., and have his headquarters at Rochester, N. Y.

JOHN KELKER, Division Master Mechanic of the Denver & Rio Grande R. R., at Pueblo, Col., has been appointed Master Mechanic at Denver, Col., to succeed JAMES R. GROVES, resigned.

JAMES C. CLARK, late President of the Illinois Central R. R., has been appointed General Manager of the Mobile & Ohio R. R., to succeed Col. T. M. R. Talcott, resigned.

C. H. HUDSON has been appointed General Manager of the East Tennesee, Virginia & Georgia R. R., with office at Knoxville, Tenn., to succeed E. B. THOMAS, resigned.

J. H. STAATS, late Engineer for ROSS & SANFORD, general contractors, of Jersey City, has formed a partnership with R. P. STAATS, to engage in general contracting with harbor works as a special feature. Their offices are at 171 Broadway, New York City.

ALEXANDER M. CUMMINGS died last week. He took part in the construction of the first "monitor" and was a Chief Engineer in the U. S. Navy. He retired from the service after the war and was connected with the United States Dredging Co., of this city.

CHAS. H. SMITH, who has been engaged as engineer on the Western division of the New York, Lake Erie & Western R. R., has been appointed Assistant Engineer to E. CANFIELD, Chief Engineer of the New York, Ontario & Western R. R., with headquarters at Middletown, N. Y.

HENRY D. DUPEE announces that his business will be carried on under the name of the WALPOLE DYE & CHEMICAL CO., with offices at 117 Milk street, Boston, and 18 Cedar street, New York, and his goods will be sold exclusively by J. A. and W. BIRD & Co., of Boston and New York. Mr. DUPEE'S interest will be retained in the business thus transferred, and his friends and patrons are invited to continue their favor to his agents, being assured of greatly increased facilities for supplying their wants. GEISENHEIMER & Co., 22 Liberty street, New York, will retain the agency for Philadelphia and the South.

M. GILLEAS, Superentendent of the Iowa division of the Illinois Central R. R., has been appointed General Manager of that division: A. M. QUIMBY, Assistant Superintendent, will be promoted to Supeiintendent, and will assume charge of the division from Dubuque, Ia., to Fort Dodge, including the Northern branch from Waterloo to Mona. C. K. DIXON, Trainmaster, at Waterloo, Ia., has been appointed Superintendent of the division from Fort Dodge to Sioux City, including the Cherohee & Dakota branch; his office will be at Cherokee.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—Meeting of Jan. 4. President WORTHEN in the Chair and a very full attendance. Business commenced with some informal discussion concerning the Society Building Fund. It is understood that the progress being made is very gratifying and the project started at the Kaaterskill meeting promises to assume proportions then undreamed of.

The paper of the meeting was one of very unusual importance and public as well as professional interest This was "The North River Bridge Problem, with a Discussion on Long Span Bridges," read by the author, Mr. G. LINDENTHAL, M. Am. Soc. C. E. As we expect to give this paper in very full detail in a following issue, it is only now necessary to state that Mr. LINDENTHAL exhibited fully worked out detailed plans and described a bridge designed by him to cross the North river at New York. The colossal proportions of this structure can be best realized by giving a few of the dimensions, as follows: It will be a stiffened suspension bridge with two cables each 4 ft. in diameter, in four quadrant sections separated by packing blocks. The river span would be 2,850 ft. with 145 ft. headway, and the total length would be about 6,600 ft. The roadway will be 86 ft. wide and accommodate six railroad tracks. The two main towers would be of steel and iron, 500 ft. above the surface of the river and, on the New York side, resting on foundations 175 ft. deep. The paper and discussion by the author, which followed, were exhaustive essays on the unprecedented problems here submitted to the engineer, and the methods devised by the author to meet the difficult conditions. Aside from its importance as practically inaugurating a structure that must sooner or later bridge the Hudson at this point, the paper was of extreme value for its data on the general subject of long span bridges as resulting from years of study on the part of an engineer experienced in such construction. While long, the paper was listened to with great and patient interest and most vigorously applauded.

The following candidates were found elected:

FOR MEMBERS:

CHANNING MOORE BOLTON, Chief Engineer Richmond and Danville R. R. and Manager Richmond City Street Railway, Washington, D. C.

DE CLERMONT DUNLAP, Division Engineer, Kansas City Extension C. M. & St. P. Ry., Chicago Ill.

HENRY HOLBROOK GLADDING, (Sheffield Sci. School, 1881) (Elected Junior, July 1, 1885.) Engaged chiefly on Sewerage, New Haven, Conn.

ARTHUR HAVILAND, (Elected Junior Jan 4. 1882.) Sanitary Engineer and Assistant City Engineer, San Antonio, Texas.

CAMILLE STANISLAUS D'INVILLIERS, (Poll. Coll. Phila. 1877.) Engineer in charge Surveys and Construction Tyrone Div. Pennsylvania R. R. in Clearfield Coal Region, Phillipsburg, Pa.

CHARLES HEES LEDLIE, Civil Engineer, St. Louis, Mo.

HENRY BENJAMIN PATTEN, (Rens. Pol. 1878.) Division Engineer Wyoming Division Union Pacific Ry., Cheyenne, Wyo.

FREDERIC JOHN HENRY RICKON, City Engineer, Little Rock, Ark.

JOHN MUIRHEAD STEWART, (Sheffield Sci. School 1874.) (Elected Junior, March 2, 1887.) Assistant Engineer New Croton Aqueduct, Dobbs Ferry, N. Y.

GEORGE FRANCIS WRIGHT. (U. S. Naval Acad. 1869.) City Surveyor, Santa Barbara, Cal.

FOR JUNIORS.

JULIUS LEROY ADAMS, engaged in Engineer Corps, Dept. Public Parks, New York City: on survey of proposed Quaker Bridge Dam and Reservoir; construction Williams' Bridge Reservoir, Brooklyn, N. Y.

FRANCIS HENRY BAINBRIDGE, (Rens. Pol. 1884.) Assistant Engineer Edge Moor Iron Co., Wilmington, Del.

EUGENE CARROLL, (U. S. Naval Acad. 1881.) Resident Engineer Covington Transfer Ry., Covington, Ky.

RUSSELL WADSWORTH HILDRETH, (School of Mines, Columbia Coll. 1885,) engaged in shops in Union Bridge Co., at Athens, Pa., on the Willamette River Bridge for Oregon Ry. and Navigation Co.

ALEXANDER EDWARD KASTL, (Univ. Mich. 1885.) Transitman Atchison, Topeka and Santa Fe R. R., Chicago, Ill.

WILLIAM ANTHONY LYDON, (Lehigh Univ. 1886.) Assistant Engineer with Drainage and Water Supply Commission, Chicago, Ill.

ALEXANDER POTTER, Assistant in office of Chief Engineer Chicago, Santa Fe and California Ry., Kansas City, Mo.

Engineers' Club of Philadelphia.—The Tenth Annual Meeting of the Club will be held on January 14. Mr. THOMAS M. CLEEMANN, the retiring President, will deliver the Annual Address, and the ballots for officers for 1888 will be opened. Mr. Jos. M. WILSON is nominated for the next President.

Indiana Society of Civil Engineers and Surveyors.—The Eighth Annual Meeting of the Society will be held at the surveyor's office in the Court House, Indianapolis, Ind., on January 17, 18 and 19. The programme is as follows:

1st day: Organization at 2 P. M.; reports of officers; installation of officers elect; report of committee on legislation. Evening session, report of committee on statistics, discussion.—2nd day: Report of committee on engineering and surveying; papers and discussion. Afternoon session: report of committee on drainage; papers and discussion. Evening session: Questions in Practice, by R. I. MORRISON; report of committee on instruments, blanks and records, followed by miscellaneous papers and discussion.—3rd day; report of committee on public highways and bridges; papers and discussion. Afternoon session; election of officers; miscellaneous business. Adjourned.

Reduced rates on railroads can be secured provided 50 or more attend. All persons coming to the meeting should secure a certificate of fare paid; blank certificates are left on hand by ticket agents of all lines members of the Central Traffic Association, and will be furnished on application.

Several interesting papers have already been prepared by some leading teachers. A number of instrument makers expect to be there, also several bridge engineers.

LEWIS S. ALTER, Corresponding Secretary.

Connecticut Association of Civil Engineers and Surveyors.—The Fourth Annual Meeting will be held at Hartford, Conn., at the office of C. H. BUNCE, City Engineer, on Tuesday, January, 10, at 10.30 A. M. The programme is as follows:

10.30 A. M.—Business meeting, including the consideration of the proposed amendment to the constitution; election of officers, and the transaction of any business proper to be brought before said meeting.

1.00 P. M.—Dinner.

2.00 P. M.—1st paper, "The Preparation of Submarine Foundations," by GEO. W. FULLER, Submarine Engineer, Norwich, Conn. 2nd paper, "Adjustable Effluent Pipe, Middletown Water-Works," by E. P. AUGUR, City Engineer, Middletown, Conn.

4.00 P. M.—Discussion of "Rental Value of Hydrant Services," continued from November meeting.—3rd paper.—"The Bath Water-Works," by F. B. DURPHY, the contractor, Norwich, Conn.

6.00 P. M.—Supper.

7.00 P. M.—4th paper, "A Method of Plotting by Rectangular Co-ordinates," by F. W. WHITLOCK, C. E., Waterbury, Conn.—5th paper, "Mason Work," by F. H. MCKENZIE, C. E., Southington, Conn.

Hotel charges, including dinner, supper, lodging and breakfast, $2.50.

D. S. BRINSMADE, E. P. AUGUR, Secretaries

Master Car Builders' Association.—The Next Annual Convention will be held at Alexandria Bay, N. Y., June 12, 1888. The following subjects are to be reported on by special committees:

1. Standards and Appliances for the Safety of Trainmen.
2. Automatic Freight Car Brakes.
3. The Best Form and Construction of Car Roofs.
4. Car Heating.
5. Wheels.
6. Journal Lubrication and the Best Practice for Economizing Oil.
7. The Best Form of Door Hangings, including Grain Doors.
8. How can Uniformity in the Interchangeable Parts of Cars be Obtained.
9. Committee of Arbitration in Disputed Cases under the Rules of Interchange.
10 and 11. Subjects and Arrangements for Next Convention.

THE Birmingham (England) Central Tramways Co. is having a time of it in testing inventions proposed to prevent accidents to pedestrians who encounter the engine. Among the later devices is a projecting framework of wooden laths carrying a series of revolving india-rubber rollers at the front end. Each inventor is striving, either by some contrivance, to kick the obstructing pedestrian out of the way or to pick him up and carry him until the engine is stopped. No device of the many tried has yet proved feasible. The best plan is to keep off the track.

An Automatic Alarm Water Gauge.

Eternal vigilance has always been quoted as the market price of safety; but as human nature is at present constituted it is about impossible to obtain any absolute safety in this manner. There is no man who is not subject to occasional moods of relaxation

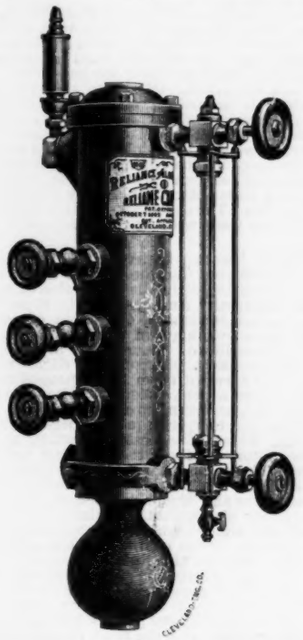

Fig. 1.

when his mind is off his work and he performs it merely automatically. The modern idea of safety is to dispense as far as possible with fallible human vigilance and employ in its stead some form of automatic guard, the universal end of which is to make the source of danger mechanically defeat itself or surely indicate its presence to the attendant.

Fig. 2.

Neither idea was entirely satisfactory and modern progress, in so far as the subject of this sketch is concerned, has united both with probably the most satisfactory results yet obtained.

The device illustrated in Fig. 1 is a Safety Water Column which combines gauge glass, guage cocks and automatic high and low water alarms. As will be observed by Fig. 2, which shows the operation of the device, it does not assume to remedy the evil itself but simply attracts attention to its existence, leaving human skill and good judgment to correct it in whatever manner the exigencies of the case may require. Such being the case this device acts as a spur and doubles the vigilance of the attendant who on account of personal pride and other important considerations is especially careful to keep the water right in order that the whistle may not sound. Thus we find not only the automatic appliance but extra vigilance going hand in hand to secure the much coveted safety.

The operation of the column is exceedingly simple. In the column are two hollow copper floats of special construction, which operate the valves with which these are connected by bell crank levers. In operation, with the water at the proper height, the water line comes between these floats leaving the lower one submerged and, pressing upward, it holds the low water valve closed so long as the water does not get low enough to leave the float unsupported, but whenever it does get low the float opens the valve by force of gravity. The high water alarm is the reverse of the low water alarm, the weight of the float holding the valve closed until the water gets sufficiently high to raise it. The connections are such that the water line cannot pass either the upper or lower gauge cock without automatically sounding the alarm.

The sediment chamber at the bottom is a decided addition to the safety of the gauge glass and gauge cocks. The patent floats are made of seamless copper without solder and will withstand high pressure. The valves admitting steam to the whistle are at the top of the column where they cannot be affected by water or sediment.

The injury which many boilers suffer from occasional low water is two little appreciated by steam users in general. And any device which ensures that the crown sheet or flues shall never be dry merits the popularity which this fixture has already attained. The Reliance Gauge Co. of Cleveland are the manufacturers, and they would be pleased to forward illustrated pamphlets and any information desired to any one interested.

THE December Pilot chart, issued by the Hydrographic Office, U. S. Navy, gives the story of three derelict vessels. The Ship *Ada Iredale* caught fire in the South Pacific and was abandoned Oct. 15, 1876; she drifted 2,423 miles to Tahaiti and was towed into port, still burning, on June 8, 1877; she continued to burn until May, 1878 when she was repaired. The ship *Oriflame* was abandoned on fire in June, 1881, in the Pacific; on Oct. 24 she was sighted, and on Feb. 12, 1882, she drifted ashore on the island of Rasoria, having been driven by wind and current 2,840 miles in 8 months. The schooner *Twenty one Friends* was abandoned about 120 miles off the Capes of Chesapeake Bay in March, 1884; she was carried by the Gulf Stream first about E. N. E., and then towards the coast of Spain; and in Dec. 1884 was about 130 miles off Cape Finisterre. She drifted 3,525 miles in 8 months, 10 days.

THE tunnel on the Minnesota & Northwestern R. R., near Galena, Ill., was completed on Jan. 2. It is 3,460 ft. long, 25 ft. wide and 26 ft. high. Tunnel driving was commenced on April 1, 1887 through a slate formation which the press accounts describe as "thick and pulpy" whatever that may mean.

Mr. KEELY, of motor fame, is having a hard task assigned him by a Mr. WILSON of Philadelphia, who claims an interest in "said inventions." Mr. WILSON sues to obtain an accounting of all moneys paid Mr. KEELY, to restrain him from changing or varying the construction of the motor, and, more difficult still, "to fully disclose to him the invention and the mode of constructing and operating the same." We wish Mr. WILSON success in his arduous enterprise.

Water Supply and its Development for Small Cities in the West.*

Concluded from page 480.

The usual custom of appointing a commission or committee, to investigate the matter is a very good one, and their trip around the country to inspect various water-works, gives them a knowledge of the subject, which will be of great assistance to them in their future duties. It is serviceable thus far, but no farther. It is surely a mistake to let such an investigation conclude to them that a system of water supply or water-works in any neighboring town, is exactly what is wanted in their own town, and so recommend to the people or Common Council; for, as yet, there is nothing to show its adaptation to local circumstances and conditions.

The best way for such a committee is, in the very beginning of their work, to select a competent engineer to study the question with them; to determine by necessary tests the best locality for a water-supply, its quality and amount, and the best means of developing it. Let him submit a report, with an estimate of cost of the entire water-works, best adapted to the needs and means of the community. This puts the matter in a tangible form to present to the public for discussion and note. They know then just what they are doing, and how far they can carry their undertaking.

Such a preliminary investigation is not putting the people to any extra expense, for it will have to be made before any reliable and complete set of plans are prepared and the proper time to make it, is before any popular vote is taken or the issue of bonds for the work, or any franchise granted to a Construction Company.

In most cases where a franchise is granted, the people cannot be too particular as to where their water supply is coming from, and how it is to be preserved from contamination. Such an investigation and report as the one suggested, is a communities' safeguard; and if municipal authorities would take such a rational view of the case, they would often save themselves vexations, delays and embarrassing failures. If some method of this kind is not adopted, but the work projected and constructed in an unsystematic way, it is simply a question of a few years before the expert will be called to perform the very work that should have initiated the enterprise; and it may be at greater expense to the city, for a remodelling of a plan is by no means economical or satisfactory.

Those communities who have located their water supply in their midst, in the corporate limits of the town, where the soil is for years liable to defilement whether the town is sewered or not, have particularly this question to consider in a two-fold way.

First. Ground in town is expensive, and they usually have made little or no provision for the future extension of their works.

Second. The location is so opposed to any proper sanitary regulations, that it is only a matter of little time, before a healthy public sentiment will fully appreciate this circumstance, and compel a relocation away from all possible chance of such foul pollution.

The method of development, as well as the location of a water-supply, is a fundamental consideration, and is to be studied as an isolated problem, as far as the most feasible adoption of a means to an end is concerned. It is poor policy to assume as sometimes done, that any mechanical means of developing a water supply, is worthy of a general application, even over a limited territory, because it has been successful in any one or two places. This is simply "putting the cart before the horse" The conditions and peculiar requirements of the town and surroundings must first be determined; then apply that method most suited to the occasion.

In this section of the country where the supply comes from a river or a natural lake, direct connection is usually made with the pumping machinery. Sometimes auxiliary filters are constructed in the tanks, but experience has shown that these very often become useless by clogging with silt, and that they need constant attention. Artificial filters are now constructed by several companies; and great pains are being taken to make them successful as an attachment to a water works system.

Sediment is very readily disposed of by settling in basins properly apportioned to the size of the water-works system.

When ground water is the source of supply, resort is usually had to infiltration galleries; large open wells, systems of drive wells, arranged in gangs, and bored wells, sometimes the last of large size; each well fitted with an independent steam pump.

Infiltration galleries are usually constructed in the porous material near a river. Such galleries should be kept covered, for the collected water,

being in reality filtered, is liable to pollution if exposed to the light and heat of the sun.

Open wells are one of a variety of infiltration galleries covering a small area of ground, but penetrating deeper to reach a suitable water bearing material; in relation to them, it has been determined that the bottom area alone can be depended on to furnish water.

Thorough tests should precede the sinking of such wells, so that the various materials to be encountered, and their depth are definitely known and the most satisfactory point of stopping the excavation thereby determined.

Serious mistakes have frequently been made by unintentionally uncovering deep beds of quick sand or clay, which a little knowledge in advance would have prevented.

Perhaps the best example of drive wells arranged in gangs is the system used in Brooklyn, New York. Here the wells are in pairs on each side of a main suction pipe.

In distributing drive wells along a pipe or in any manner to draw water from the ground, it is necessary first to know the maximum demands on the system, the rate at which the soil is capable of furnishing water, and the depth of the water bearing strata. No well should, during its maximum draft, approach the limiting capacity of the soil to furnish water, nor should the draft be so severe as to permit the hydraulic grade line to fall below the top of the entrance to the pipe, as this will constantly impair its action.

As an example of what an improper distribution of wells will do, a case may be cited where a failure occurred due to the incapacity of the soil to furnish water. In this case the wells, about thirty or thirty-five in number, were arranged in a circle 12 ft. in diameter, all having entrance to a tight (?) drum. Under a slow rate of pumping they operated very well, but before the draft reached the specified requirement, 1,000,000 galls. per 24 hours, the supply failed.

There was water enough in the sub-soils, as had been determined by experiment, but the fineness of the material prevented a flow rapid enough, from so limited an area of pipe distribution, to supply the demand. One-third to one-half of the driven wells were inoperative. Had the same number been properly distributed, the results would certainly have been very different.

Various methods of distributing the wells are pursued, but unless good judgment is shown in the adaptation of the method to the circumstances, and in their mechanical adjustment, they become in themselves a detriment to the collection of water.

Bored wells, 5 ins. to 8 ins. in diameter are sometimes used, when the water bearing material is at a considerable depth, each well being supplied with an independent steam pump. Such plants, being low service, require a storage reservoir of considerable capacity at the pumping station, additional high pressure pumping machinery for the distribution system and large boiler capacity. The operating expenses are necessarily heavy, due to so many independent pumps, and the large amount of fuel consumed in the manufacture of steam. Each of these methods of developing a water supply has its adaptation, but none can be recommended for any general use. In fact, it is not difficult to conceive of conditions, liable to be encountered, where each may, in turn, have superior merits, although instances where the last method can be economically and advantageously applied for water-works are exceptional. Sometimes a combination of two or more methods produces good results.

A choice of method, whether mentioned here or not, depends upon so many things, chiefly upon the requirements of the locality, as developed by test, that few suggestions can be given. It is best to rest the matter with a competent specialist, who is familiar with all these things, and let him arrange and design the plant. Such a disinterestedness is necessary in the adviser, that he can investigate the matter for the public good and not be biased by personal interests, in patented devices and so called systems of water-works.

If one will take the trouble to look over official records and the results of Health Commission investigations, the proof will be found ample to justify the most vigorous protest against the use of water from wells or in the immediate vicinity of any town. It is a historical fact that the health of cities and towns and their liability to spread epidemic diseases is largely controlled by the source and character of their water supply, and thousands of cases of cholera and similar diseases are directly traceable to a water supply contaminated by cesspool drainage and fœcal matter. Space and time will not permit me to cite the many proofs of this statement. One has only to read, to find enough to convince the most skeptical. It was once stated by the Mayor of New York that "When cholera last visited our city every case could be traced to the use of well water, while not a single case occurred where Croton water was used." In the terrible scourge in the small town of Plymouth, Pa., in 1885, the death of every individual could be directly and most conclusively traced to a water supply contaminated by a single case of typhoid fever.

An Alleged New Motor.

A communication of great seeming importance, which we take with some grains of allowance, appears in the columns of the *Evening Post* from M. LE COCQ DE LAUTREPPE in regard to an alleged new motor by which it is claimed a horse-power hour is obtained from 0.44 lb. of coal, or only about one-third of the very best records of the best marine engines, and only about two-thirds as much as a theoretically perfect condensing steam engine. The allegations are certainly "important if true," and although we must confess that we have heard nothing of any such coming miracle as this, yet it differs from most other tales of the kind in being inherently probable. Theoretically, about ½ lb. of coal should furnish a horse-power for an hour. A *perfect* condensing engine would take four times as much, a *perfect* non-condensing engine six times as much, the least available condensing engine takes eight times as much, and a good average non-condensing engine fifteen to to thirty times as much. Such a contrast makes it extremely probable that the steam engine will be eventually supplanted, and be known to future ages as a crude and barbarous machine, interesting as man's first successful attempt to obtain energy from coal and other sources of it where it was not perceptible to the senses, but only admirable as a first attempt in an entirely new field. That this new alleged "thermodynamic motor" has even the remotest chance of going down in history as the first decided step in advance, we by no means assert, for we do not as yet believe it, but the account has at least a certain plausibility, and hence is at least suggestive. It must be remembered that many different explosive gas engines have been invented and usefully worked on a small scale. This seems to be an extension of the same principle, with a cheaper way of generating gas. The main features of the account are as follows:

Some forty years ago M. CHARLES TELLIER, the inventor of the new system began to entertain the idea that air, if submitted to simple and practical phenomena, might become an agent of power much cheaper than steam. But this idea for long years was only *entrevue* from time to time, owing to other occupations of an engineer's career. He says that the sameness in all the beautiful types of machinery exhibited at the Universal Exhibition of 1878 caused him to set seriously to work to develop and to carry out the idea almost mature in his own mind. His experiments developed slowly the plan on which he was working, and it was not until two years ago that he declared to the shareholders that he was ready to construct the building of a hundred-horse-power machine. And it is a note worthy of mention that so exact were the calculations of the engineer that not two hundred francs extra were expended on the model executed after his first plan. America, always prompt to recognize new inventions, which mean new benefits to man, sent an engineer here last year to watch the progress of the motor. A syndicate of New York capitalists had authorized him to report the results of the experiments. On the 1st of October last a printed circular invited the public to visit the atelier where the machine stands perfected, measuring automatically the power it develops and the quantity of combustibles employed every moment. On Nov. 30th the American engineer declared himself satisfied, and secured the patent for the United States, for which $16,000,000 will be paid in three months' time to the Société des Moteurs Economiques. [We congratulate the Société, and hope they may get the money. ED.]

We will first look at the furnace, or what would be the furnace in a steam engine. This self-feeding apparatus, 18 ft. high, 4½ ft. in diameter, is called the *digesteur*, so called on account of its accomplishing a phenomenon similar to that of digestion. It is the generator of the power that replaces steam. Look through the small *lunettes* placed in the *digesteur*, like those in the oven of a *ceramist*—and you will see the fire. A moderate column for such a power—10 ft. high or thereabouts—yet sufficient, for every moment the air-pumps send a fresh supply of air through the *digesteur*, and this is what takes place: Carbon burning with oxygen forms carbonic acid ($C+O^2=CO^2$, as one would write it on the blackboard), or if the oxygen is in insufficient quantity, another gas called oxide of carbon is formed ($C+O=CO$). This is the one required, which takes the place of steam.

In place of stokers, a vertical chain worked by machinery carries the coal to the summit of the *digesteur*. The chain is furnished with small buckets 2 ft. apart, carrying not more than a half-pound each, and is set in motion when the gas-meters indicate the lack of carbon. Of course the summit of the *digesteur* is hermetically shut, otherwise the gases would escape, if not explode, by the admission of pure air. A double trap, superposed, moved by machinery, opens and shuts alternately to swallow the coal dropped by the chain. When nothing remains of the coal but dross, the residue falls by itself into a tank of water placed under the *digesteur* to isolate the gases. The *digesteur* is never opened; it feeds and clears itself without the means of door or grate.

From this it becomes apparent that the coal so sparingly distributed by the vertical chain is no longer a combustible, as in the production of steam, but a chemical agent. And thoroughly it performs its office, for, independent of the oxide of carbon, the tar from the burning coal produces carbonated hydrogen, also utilized. These gases are the new power. They are expelled from the *digesteurs* by the pumps that forward them to the propelling-cylinder. There was a great difficulty. They had to be compressed, and, according to a law of physics, compression raises the temperature and therefore limits compression. This is the most interesting part of the whole motor, in fact the turning point of the system. The pumps that force the gases on to the last cylinder are provided with small chains which hang over and under the piston. At every movement of the piston-rod the chains are cooled by a stream of cold water regulated by valves disposed over the piston. These chains act like a metallic sponge, which absorbs the heat produced by compression. The gases maintain a low temperature in spite of the highest pressure to which they can be submitted. The efficacy of the metallic chain is such that the gases reaching the pumps hot leave them cooled. [We consider this the most dubious part of the whole description ED.] Simultaneous with the arrival of the gases in the propelling cylinder, air, which is necessary for their conflagration, is forced in through another organ. As soon as the cylinder is full and the valve is shut, the electric spark performs its office, inflames the gases, and the detonation takes place, or rather explosion, which augments their volume and lifts the rod of the piston. This is the end. The pumps, which are continually at work, depend on this propeller for their activity; one supplies the *digesteur* with air that soon becomes oxide of carbon, and for that reason is called the gas-pump. Thus the force expended is continually replaced. The air-pump, larger than the former, sends the air to the propelling cylinder. A great point of economy is the recuperation of calorific elements which takes place directly after the gases have performed their office in the propelling cylinder. After the explosion, these gases have become carbonic acid and azote, and pass into what is called the *échangeurs*—cylinders lined with tubes—where they meet, coming in a contrary direction, the oxide of carbon, which extracts what heat is left in them. If you should pass your hand over the escape, from which issue small jets of vapor, it will come in contact with a cool stream. This escape and a scrap of the residue rejected by the *digesteur* are the two strong arguments in favor of the economy of the system and prove the application of its principle: thorough utilization of everything without waste.

As I have said, this machine represents a hundred horse-power. It burns two hundred grammes of coal per hour for every horse-power, (0.44 lb.) an economy of 80 per cent. on the fuel required for a steam engine, which consumes one kilogramme (2.2 lbs.) Besides, the *motor thermodynamique* occupies just half the space that a steam engine of the same power would require. The advantage that will result from the use of this motor in navigation begins with this consideration. Sea-going ships too often resemble the Hindu divinity that is all belly. Men-of-war, built to obtain speed on great power, seem much more like a boat built to carry the engine than the engine to propel the boat; the servitor monopolizes too much room. Dispensing with boilers and chimneys will avoid danger of explosions and that excessive heat so trying to stokers. The *digesteurs*, however important in volume and power, will not raise the temperature to an unpleasant heat. So engineers and assistants will live in a much more clement atmosphere.

On terra-firma the *moteur thermodynamique*, adapted to tramways, is recommended by the noiseless way in which it works, an important consideration in a machine intended to pass through busy thoroughfares. I have seen in the yard of the ateliers at Auteuil the little street-car constructed for demonstration running up and down its short line. No clumsy chains, as we have seen in the attempts to set street-cars in motion by electricity, but a neat little machine liberally accommodated within the space which in ordinary cars is alloted to the driver. The top of the machine just reaches the *imperiale*, and in no way can inconvenience the passengers sitting close to it.

Table I.—The Data Referring to Existing High Masonry Dams of the World.

[Accompanying Report of B. S. CHURCH, Chief Engineer, and A. FTELEY, Consulting Engineer, Croton Aqueduct.]

1 Name of Dam.	2 Location.	3 Purpose.	4 Plan.	5 Radius. Ft.	6 Versed s'ne Ft.	7 8 Height. From Flow Line to top Ft.	Height. Total. Ft.	9 10 Th'ckness. At Flow Line Ft.	At Bed Rock. Ft.	11 12 Length. At Top. Ft.	At Base. Ft.	13 14 Press. in tons per sq. ft. Upstream.	Downstream.	15 Kind of Masonry.	16 Maximum Size of Stone Used.	17 Kind of Mortar.	18 Weight of Masonry per cu. ft.	19 Area of Water-Shed in Sq. Miles.	20 Area of Res'r-voir in acr	21 Capa'ty of Resev'r in million galls.	22 Use of Crest.	23 Len'h of Was'e We'r Ft.	Max he't of water on weir, Ft.
Furens.	St. Etienne, Fr	Water Supply and Power.	Curved,	827	16.4	6.6	173.6	10.7	161	328	30	6.7	6.7	Rubble and cut trimming.	7 cu. ft.	Lime of Theil.	Assumed, 125 lbs.	9.1	—	340	Roadway	—	—
Villar.	Lozoya, Spain,	Water Sup'y	Curved.	440	—	8.2	175.2	14.8	154.5	546	—	9.6*	7.7*	Rubble,	—	Hydraulic,	Actual, 143 lbs.	—	—	4,400	Roadway	197	8.3
Gileppe.	Verviers, Belgium.	Water Supply and Power.	Curved.	1,632	45	6.5	166.5	49.2	215.8	762	269	—	9.2	Rubble and cut trimming.	One man stones.	Hydraulic,5 lime	Assumed, 143.5 lbs.	15.4	200	3,230	Roadway	(2) 82 each	6.5
Ban.	France,	—	Curved,	—	—	6.6	166.2	16.4	110	—	—	10*	8.5*	Cut trimming.	—	4 sand, 1 trass,	—	—	—	—	Roadway	—	—
Vyrnwy.	Vyrnwy River, Wales.	Water Sup'ly	—	—	—	12.0	146.0	20.0	117.8	1,350	—	8.7	6.4	Cyclopean rub'le and cut trimming.	8 tons.	—	Actual, 160.8 lbs.	—	1,115	—	Overflow	—	—
Zola.	Near Aix, Provence, Fran.	Water Supply, Power and Irrigation.	Curved,	158	37.7	4.0	126	19.0	41.9	205	23	—	—	—	—	2 sand and 1 Po't land cement.	Assumed, 137.1 lbs.	15.4	—	660	—	—	—
Habra.	Prov'nce of Oran Algiers.	Irrigation.	Straight:	—	—	8.0	137	14.1	88	1,060	—	6.6*	7.0*	—	—	Hydraulic lime.	Assumed, 152 lbs.	—	7,950	—	Foot pa'h	410	5.2
Komatau	Assibach, Bohemia.	—	Curved.	820	25	8.2	133.2	12.6	86.3	410	25	6,7*	7.3*	Cut trimming.	—	2 sand and 1 cement.	—	—	—	358	Roadway	—	—
Ternay.	Annonay, Fran'e	Power.	Curved.	1,312	—	12.0	130.0	15.7	81.7	—	—	7.1*	8.1*	—	—	—	Assumed, 167 lbs.	—	675	—	—	197	—
Hamiz.	Algeria.	Irrigation.	Straight.	—	—	—	134.5	16.4	91.2	331	131.2	—	11	Rubble.	—	—	—	54	—	3,430	—	—	—
Granche-urfas.	Algeria.	—	Straight,	—	—	—	131	13.12	134.5	508	164	—	6	Rubble.	—	—	—	—	—	4,224	—	—	—
Tlelat(to be ral'd hig'r)	Algeria.	Water Supply and Irrigat'n	Straight,	—	—	—	68	13.12	40.3	325	—	—	6	Rubble.	—	—	—	50	—	145	—	—	—
Djidionia (to be raised higher).	Algeria.	—	Straight.	—	—	—	83.6	13.12	52.5	196	—	—	9.5	Rubble lower part in concrete.	—	—	—	327	—	528	—	—	—
Boyd's Corners.	Putnam County, N. Y.	Water Supply.	—	—	—	3.0	78	8.6	57	670	—	—	—	Concrete, with stone facing.	—	Rosendale cem't	—	—	279	2,723	—	100	—
Geelong.	Victoria, Australia.	Water Supply.	Curved.	300	20	1.0	68	2.5	44	226	—	3.6*	4.0*	Concrete, blue stone coping,	—	Stone 4½ screenings, 1½ Sand. 1½ Portland Cement, 1.	Act'al,143 lbs	4.7	26	142	Overflow	30	—
Puentes.	Province of Sorca, Spain.	Irrigation.	Polygonal,	—	—	—	164	35.7	146.9	925	70	—	8.1	Cut revetments.	—	—	—	—	—	—	—	—	—
Alicante	Province of Alicante, Spain.	Irrigation.	Curved,	351	13.1	—	134.5	65.6	110.5	190	20.5	—	11.6	Cut revetments.	—	—	—	—	—	980	—	—	—
Val de Infierno.	Province of Sorca, Spain.	Irrigation.	Polygonal,	—	—	—	116	41.1	137.0	330	67	—	6.7	—	—	—	—	—	—	—	—	—	—
Lozoya.	Madrid, Spain.	Water Supply.	Straight.	—	—	—	105	22.0	128	291	200	—	—	About ½ cut st'e	—	—	—	—	—	—	—	27.5	11
Nijar.	Province of Almeria, Spain.	Irrigation.	Curved,	—	—	—	101.5	24.3	67.6	355	83	—	7.7	Cut revetments.	—	—	—	—	—	3,990	—	—	5.3
Elche.	Province of Alicante, Spain.	Irrigation.	Curved,	205	—	—	76	29.5	39.4	230	60	—	13.0	Cut revetments.	—	—	—	—	—	—	—	—	—
Almanza	Province of Valencia, Spain.	Irrigation.	Curved,	86	—	—	68	9.8	33.8	262	45	—	14.3	Cut revetments.	—	—	—	—	—	—	—	39	6.6
Near, San Mateo rece'y b'g'n	California, U. S. A.	Water-Works, (San Francis.)	Curved,	637	—	—	170	20*	176	700*	—	—	—	Concrete.	—	Portland Cem't	—	24 (takes surplus water from l'rge additional area)	1,800	32,000	—	—	—

NOTE.—Data marked thus * have been calculated.

The Engineer President of the French Republic.

In recognition of the highest civil honor ever conferred upon a member of the engineering profession, *Le Genie Civil*, the leading technical journal of France, salutes the new President of the Republic as translated below. The address is thoroughly typical of the Frenchman; but all engineers, French or foreign, doubtless feel like gratification in the elevation of a worthy member of their profession to one of the highest positions in the gift of man:

CARNOT: President of the Republic. We very respectfully salute, and not without pride, the new President of the Republic, who is one of us.

Engineers throughout the world, by the force of circumstances, must feel gratification at this unexpected event. Among the candidates put forward MM. FLOQUET, JULES FERRY and DE FREYCINET. There were two advocates, as preceding them were two other advocates, MM. THIERS and GREVY, with a Marshal of France between. Will the Engineer, in his turn, bear down the balance of the destinies of the country with a weight equal to his learning, to his work and to his character during the century past?

We dare not affirm it; but the peace made by the national name of the great CARNOT, so worthily borne by his grandson, Engineer, ought to be written upon the pages of engineering history.

We do not deceive ourselves: the Congress has made an excellent political choice, and elected him: engineer or advocate, calling himself CARNOT, he would have had the same votes, if he had rendered, as M. SADI-CARNOT, the same services as Deputy and Minister.

Nevertheless, it is profoundly satisfactory to know the fact that the nation by the voice of 616 of its representatives out of 827 voting, and in a manner as simple as it was grand, has been able to find, as in the olden times of prosperous republics, an honest man in the best acceptation of the term, one whose name and personal character marked the immediate end of a, perhaps, fatal crisis.

Salute then that one who has cut the Gordian knot; salute the grandson of the grand CARNOT, who has succeded in calming the tempest and who inaugurates the era, long hoped for, of concord among Frenchmen.

The daily and political press has reproduced and commented upon the words pronounced by the new President of the Republic immediately after the notification of his election by the President of Congress, in response to the congratulations expressed in the name of the whole Congress, of all the Ministers and of the President of the Chamber.

Behold this firm and dignified address, unprepared, which we recall without comments:

Sirs: I thank you profoundly for the congratulations and sentiments which you so well express to me. I am filled with gratitude toward the members of the National Assembly who, in uniting their votes upon my name, have so highly testified that desire for peace with which republican France is animated.

My dearest wish is that this great day may stay present in every mind and heart. It signifies that the representatives of France know how to unite. Their common efforts can and should assure the constitution and the regular advance of a stable government, active and capable of giving to the nation, with liberty within and dignity without, all the benefits that our country expects of the Republic.

Once more thanks, Gentlemen; you can count upon my entire devotion.

ENGINEERING NEWS.

AMONG the new schemes for rapid transit for this city is one proposed by Mr. DAVID H. KING. Property is to be secured along the proposed line and a four-storied fire proof building erected thereon; in the cellars of these buildings and under the streets, is to be the underground road; on the first floor would be stores and on the second floor an elevated railway. He estimated the cost of such a road of four lines of rails at $4,000,000 to $5,000,000 per mile, and that the same space could be utilized for electric wires, pneumatic tubes, etc. This is very much after the plan suggested for an elevated road by this journal, with a subway added. It would probably be less expensive and preferable to stick to our original suggestion and put both lines of track above ground.

IT is said that Mr. ANDREWS, of Pittsburg, Pa., long associated with the late Mr. JAS. B. EADS in his several great enterprises, will soon sail for England with the purpose of interesting capitalists there in the Eads ship railway. The sum named as necessary for the success of the enterprise is $40,000,000.

THE special committee of the Aqueduct Commission appointed to examine the claims of the aqueduct contractors for extra work have reported, and recommend the adoption of the following resolution, which was agreed to:

Resolved, That the cross section of tunnel excavation, excepting timber sections, should be the area of the conduit plus that of the masonry around the conduit necessary to preserve the shape of the conduit against the pressure of the surrounding medium; allowances to be made for the necessary weepers and other contrivances specially mentioned in the contracts; and the Chief Engineer and the Consulting Engineer will report whether the methods of calculation adopted to this time conform to the principle above enunciated; and that they present an average typical cross section or cross sections, showing what allowances should be made; embracing in said cross section or cross sections the area of the conduit, the necessary masonry, necessary weepers and other contrivances as above specified.

This practically gives the contractors pay for the extra excavation outside of the normal section, whenever this extra work is deemed by the engineers an essential part of the work. It leaves, as it should and was recommended in our late editorial, the fixing of quantities and dimensions of disputed sections to the engineers. The excepting of the timber sections is likely, however, to give rise to some further controversy.

THE following bridge accidents are reported. On Dec. 28 a freight train on the Louisville & Nashville Railroad was derailed near a trestle near Athens, Ala. The engine passed over in safety but the derailed cars broke down the trestle. One man was killed. This is another case where a rerailing guard would have been of service.——On Dec. 29 an engine and tender on the Elmira, Cortland & Northern Railroad broke through an iron bridge at Cazenovia, N. Y., which had recently been repaired. ——On Dec. 30 a mixed train on the Pittsburg & Western Railroad went over a 30 ft. trestle near St. Petersburg, Pa. The wreck caught fire from a car stove and was consumed.

HEAVY storms of wind, rain and snow have done considerable damage in New York and New England. Three landslides occurred Dec. 29 on the Alabama Great Southern Railroad. An express passenger train and a freight train were wrecked. Ice in the Allegheny river damaged the wickets of the Davis Island dam, on Jan. 2, to the extent of $3,000. The partially erected iron bridge over the Allegheny river from Pittsburg to Herrs island and Allegheny, Pa., was wrecked by ice carrying away the timber false works. The loss is estimated variously between $15,000 and $25,000.

THE Commission report on the bridges of New York State will, we are informed, be issued soon. Some 600 pages are now in print.

On Jan. 2 a break occurred in the reservoir at Elizabeth, N. J., and the neighborhood was flooded. The reservoir was soon repaired. The break is supposed to have been caused by musk rats.

THE Canal Union of the State of New York will demand of the present Legislature an appropriation of $1,000,000 for the improvement of canals in this State. This amount will be apportioned as follows if received; To the Erie canal $350,000; for lengthway 14 locks and $250,000 for deepening the canal. To the Oswego canal, $100,000; $50,000 for enlarging two locks and the same amount for deepening. To the Champlain canal, $200,000; to the Cayuga and Seneca $50,000 and $50,000 for deepening the Black river. The bill will be introduced next week

THE latest news from the Bolan Pass is that Mr. G. L. MOLESWORTH, the consulting engineer to the Indian Government, has recommended that the whole of the Bolan system be converted to a broad gauge road the ABT system. Locomotives and track are said to have already been ordered from Messrs. RENECKER, ABT & Co., of Wurzeburg, by the Indian authorities.

THE work of moving the great Coney Island hotels back from the encroaching waves is now actively progressing. The Brighton is to be moved back 555 ft., and to accomplish this a forest of piles have been driven, extending under the hotel, and on these 24 tracks to be occupied by 125 iron flat cars will be placed, the flat cars to be drawn by eight or ten locomotives standing on five different tracks, a rather novel way of moving buildings. An enormous sum has been spent in resisting the encroachment of the sea at Coney Island, with but slight effect, and it now appears to have been wisely determined to abandon the effort and simply move back out of the way.

Pedestrian Tunnels for Chicago Rivers.

A lecture was recently delivered before the Technical Society of Chicago, by H. A. STOLTENBURG, C. E., on the subject of "Pedestrian Tunnels." The author called attention to the well known obstruction to street traffic in Chicago caused by the frequent opening of the river bridges to allow vessels to pass through. He instanced the new Thames bridge at London, England, where pedestrian traffic will be continued over a high level bridge, while the main bridge is open for the passage of vessels, access being obtained to the pedestrian bridge by elevators in the abutment towers. He did not think this system advisable for Chicago on account of the great cost, the estimated cost of the new London bridge being about $3,500,000, but suggested tunnels for the special use of pedestrians. He proposed iron tunnels, about 10 ft. diameter, with an external bedding of concrete, which would be economical as regards time and cost of construction, and estimated the cost at $40 per lin. ft. Each tunnel would have two shafts on both sides of the river, one for an elevator and the other for a spiral stairway. Revenue was proposed from telephone and other wires, etc., laid through the tunnel. The total cost of a tunnel, including elevators, etc., was estimated at $40,000, and eight such tunnels were proposed, aggregating $320,000. It was stated that the cost of the 12th street bridge and viaduct was $340,000. Mention was also made of the subway now under construction below the Thames, at London.

Value of Foreign Coins.

WASHINGTON, DEC. 28.—The Director of the Mint has estimated the values of the standard coins of the various nations of the world, to be proclaimed by the Secretary of the Treasury Jan. 1, as follows: The florin of Austria, 34.5.c; boliviano of Boliva, 69.9c.; sucre of Ecuador, 69.9c.; rupee of India, 33.28c.; silver yen of Japan, 75.3c.; dollar of Mexico, 75.9c.; sol of Peru, 69.9c.; rouble of Russia, 55.9c.; mahbub of Tripoli, 63c.; peso of the United States of Colombia, 69.9c.; bolivar of Venezuela, 14c. Heretofore Venezuela has had the double standard, but by the law of May 27, 1887, silver was made the standard of value. The Director has also estimated the values of the monetary units of the Central American States, Guatemala, Honduras and Nicaragua, the silver peso, the value given it being 69.9c.

CONSTRUCTION NEWS.

Water.

MONTPELIER, VT.—The Water Commissioners have issued their report for the year ending Nov. 23, 1887, being the fourth annual report. There are 12.43 miles of pipe, 54 hydrants and 60 gates. They recommended that the interest on the water debt be met by taxation or by the village paying rental for hydrants, watering troughs, etc.; also that the net income from the water be applied to paying off the debt. At a meeting of the voters on Dec. 5, the commissioners were re-elected and it was voted that the village should pay $25 per hydrant for water for fire purpose.

ST. CATHARINES, ONT., CANADA.—The Water Commissioners have submitted to the City Council the annual report for the year ending December 31, 1886. While the water supply is practically inexhaustible, it is stated that the capacity of the lower or distributing reservoir is the limit of potable

water for many months in the year when the upper reservoir is disturbed by the creek freshets, and the superintendent recommends that provision be made for increased storage capacity. It is also suggested that there is a considerable amount of needless waste. The system comprises 18.994 miles of pipe (30, 20¼, 20, 19¼, 16, 12, 10, 8, 6 and 4-in), 185 valves and 145 hydrants. J. ALBERT MILLS is Superintendent.

CANISTEO, N. Y.—The new water-works have been tested, with satisfactory results, and accepted by the city. Four streams were thrown simultaneously to a height of 70 ft. There is a reservoir with a capacity of about 2,000,000 galls., 6½ miles of 4, 6, 8 and 10-in- pipe; 50 fire hydrants and 35 valves. The contractors were James H. Harlow & Co., of Pittsburg, Pa., who were awarded the contract in in August, 1887.

WORCESTER, MASS.—The Water Committee have issued their report for the year ending Nov. 30, 1887. During the year 6.13 miles of pipe were laid, 57 gates added, making a total of 997, and 31 hydrants added, making a total of 842. Of service pipe, from ⅝-in. to 6-in., 9,674 ft. were laid. During the year the Mellert Foundry Co., of Reading, Pa., supplied 807 tons of pipe and 47 tons of castings; Caleb Colvin supplied 27 tons of castings. Of meters, 500 were set, making a total of 6,854. The sewers were extended 34,361.6 ft., with 285 manholes and 121 catch basins. The system now comprises 62.89 miles of sewers, 2367 manholes and 1,342 catch basins.

COUNCIL BLUFFS, IA.—The water is taken from the Missouri river about a mile above the pumping station, the suction pipe extending out into the channel. The water passes through a settling reservoir before it is reaches the pump well; it is then pumped to two reservoirs with a capacity of 6,000,000 galls. each, and thence to a distributing reservoir of 4,000,000 galls. capacity in Prospect Park. The supply from the reservoir is by gravity. There are three pumping engines with a daily capacity of 7,000,000 galls.; about 25 miles of pipe and 201 hydrants. The present consumption is about 1,700,000 galls. per day. The hydrant pressure at Park avenue was 135 lbs.

NASHVILLE, TENN.—Capt. GEORGE REYER, Superintendent of Water-Works, has presented his annual report to the Board of Public Affairs. The average daily consumption was 8,522,762. The pumping machinery consists of 4 compound, non-condensing Worthington engines, with daily capacity of 2,500,000 galls. each, and 1 horizontal engine, with vertical pumps, with a daily capacity of 4,000,000 galls. The water is drawn from the Cumberland river and pumped to reservoir and stand-pipe. There are 42 miles 2,106 ft. of 3 to 36-in. cast-iron mains; 16 gates and 16 hydrants were added. Range of pressure, 10 to 60 lbs. Lead and cast-iron service pipe is used. The waste of water is said to be reckless and extravagant, but meters have not proved satisfactory on account of the muddy condition of the water. Population, 75,000.

BROWNWOOD, TEX.—Brownwood, the capital of Brown county, is situated on the Gulf, Colorado & Santa Fé R. R. Population about 4,000. The works were designed in March, 1886, by M. L. Lynch, Consulting Engineer, of Temple, Tex., and contracted for by R. D. Wood & Co. of Philadelphia, who completed them in October last. The water is taken from a natural reservoir in the bed of Pecan bayou, a little more than 2 miles from Court House square. The plant consists of two 40 H. P. tubular steel boilers and two compound, duplex Worthington pumps, one of 10-in. and 18-in. × 8½-in. × 10-in. stroke, and one of 14-in. and 20-in. × 12-in. × 10-in. stroke. The stand-pipe is 20 ft. diameter and 100 ft. high. There are a little more than 4½ miles of cast iron mains, from 6 to 10 ins. diam., with small stretch of 4-in. sub-main; 37 fire hydrants. The direct pressure test gave 4 fire streams through 100 ft. of hose and 1-in. nozzle, from 95 to 100 ft. high, and from stand-pipe pressure 70 ft. high. The works are owned by the city and cost $46,000.

ASHTABULA, O.—With regard to the note on p. 482 of Dec. 31, 1887, that the city would not pay the agreed price for water for fire purposes on account of the pipes not being laid as required, we learn from good authority that the dispute is a question between 5 ft. trench and 5ft. cover. The contract and specifications called for 5 ft. cover over the pipes, but the pipe layer interpreted the instructions to mean 5 ft. depth of trench and so dug the trench. It is stated that there is no fear of water freezing in the mains and that in all other respects the works go beyond the expectation of the authorities.

NEW BRUNSWICK, N. J., Jan. 3, 1888.

EDITOR ENGINEERING NEWS: In your issue of Dec. 31, 1887, the reported failure in the water supply at Perth Amboy is published under the head of "Water Famine in New Brunswick, N. J." Will you kindly make correction and oblige.

A. J. JONES, *Superintendent.*

WATER-WORKS.—*Massachusetts.* Salem. The Water Works Committee has reported in favor of a new 20-in. main from Wenham, *via* Danvers, in the near future, at an estimated cost of $210,000. The committee recommends that action be taken by cities and towns to secure legislation in regard to having cities and towns connect their water-works where practicable, so that temporary supplies may be had in cases of emergencies.——Sandwich. The town expects to have water-works in a short time. A petition for a charter to incorporate has been presented to the legislature by parties willing to put in the system. The supply will be taken from a pond of 30 acres and pumped to a 50-ft. stand-pipe by Worthington pumps. The cost will be about $30,000. Address E. C. BOURNE, C. E., Sandwich.

New York.—Albany. Mr. A. FTELEY, M. Am. Soc. C. E., is investigating plans for conveying the water from the driven wells to the Bleecker and Prospect Hill reservoirs.——Watkins. It is proposed to bond the town for water-works and sewers.

New Jersey.—Jersey City. On Dec. 30 the pump at the high service station broke down and the Hudson City district was without water until arrangements were made for a temporary supply from the Hackensack Water Co.

Maryland.—Cambridge. A system of water-works is proposed, and is favorably considered.

Florida.—Ocala. Work has been commenced on the new water-works by the Jeter & Boardman Gas & Water Association, of Macon, Ga. The supply will be drawn from artesian wells and pumped to a water tower 76 ft. high and 25 ft. diameter, with a capacity of 100,000 galls., erected on Buckalew Heights.

Kansas.—Lawrence. The water company will filter the water supply.—Greenleaf. The new water-works were tested December 23, with satisfactory results. There are 8 Wagner steamed wells, put down by the National Water Supply Co., of Cincinnati, O., and the water is pumped to a stand-pipe 12 ft. diameter and 100 ft. high, with a capacity of 96,000 galls. The company guaranteed an ample supply for 5 years for $4,000, and the test was to pump 500,000 gals. per day for 12 consecutive days. In 4 hours they pumped 100,000 galls.

Missouri.—Kansas City. The water company will extend its system in the spring and has contracted for 3,000 tons of 30 in. pipe and will put in additional pumps, with a daily capacity of 9,000,000 galls. at Kaw Point.

Wisconsin.—Oshkosh. The city pays $70 per year per hydrant for the first 300 and $60 each beyond. There is some talk of the city purchasing the works. La Crosse.—The City Clerk has written as follows in answer to enquiries made by the City Clerk of Oshkosh; "Our water rents more than pay working expenses and repairs on water-works. Our fire protection, that is the use of hydrants, costs us only about one-third of what you pay, and our water-works can be sold for twice what they cost any day, which amount would pay our entire bonded debt and leave $125,000 for pin money." The works are owned by the city.

Colorado.—Cañon City. A water supply will be established for the prison. The water will be pumped to a reservoir.——Highland. The water supply is obtained from several wells and an artesian flowing well. Wyckoff pipe is laid. The plant cost the company $55,000, and a new pump will be put in for use in case of emergency. The town will purchase the works, erect a stand-pipe on a neighboring hill, sink another artesian well and make other improvements.

California.—Sonoma. The Sonoma Valley Water Co. has been incorporated by GEO. H. MAXWELL, of Sonoma; F. P. HOOPER, of San Francisco, and others. Capital stock, $500,000.——Los Angeles. The Vineland Water & Development Co. has been incorporated by L. H. WASHBURN and others. Capital stock, $100,000.

Canada.—Montreal. L. LESAGE, Superintendent of Water-works, has reported there is no foundation for the rumor that a water famine was probable. There will be an ample supply although the additional Worthington engine is not yet completed.——London, Ont. At a recent meeting of the electors the following resolution was carried by a large majority: "That whereas the City Council have submitted a by-law asking the property-holders of the city to grant them the privilege to raise by debenture the sum of $150,000 for water-works extension and other purposes, be it therefore resolved that this meeting disapprove of the act of the Council and request the property-holders to vote against the said by-law."

IRRIGATION.—The Amazon Irrigation Co. has been incorporated at Garden City, Kan., by C. J. JONES, E. C. REEVES and others. Capital stock $800,000.

The Taos Valley Co. has been incorporated at East St. Louis, Ill., by JOHN W. SUTHERLAND and others to operate irrigation works in Colorado and New Mexico. Capital stock, $1,500,000.

The Merced Canal & Irrigation Co. has completed its reservoir, 6 miles northeast of Merced, Cal.

At Modesto, Cal., it has been voted to issue $800,000 in bonds for a canal for the Modesto irrigation district.

At Stockton, Cal., it is proposed to divert the water of Stanislaus river into Littlejohn creek, for irrigation purposes, and to build dams for storage reservoirs in the mountains.

A. RAWLINS, County Surveyor of Martin county, Tex., proposes irrigation for the Staked Plains by means of wells.

The McPherson Canal Co. has been incorporated at Phœnix, Ariz. Contracts have been let for a part of the canal, irrigating 25,000 acres. The canal will be 40 miles long and will irrigate 100,000 acres. Capital stock, $2,000,000.

Proposals Open.

Water-Works—Complete system. H. L. HADLEY, Chairman, Water Works Committee, Washington, O. Jan. 9.

Pumping Station.—ANDREW RINKER, City Engineer, Minneapolis, Minn. Jan. 10.

Water-Works Supplies.—Pipe, specials, valves and hydrants. CHAUNCEY STRONG, City Clerk, Kalamazoo, Mich. Jan. 11.

Street Work.—Regulating, grading, guttering, curbing, trap block paving, crosswalks. THE PARK COMMISSIONERS, 49 Chambers street, New York City. Jan. 11.

Sewer.—Brick sewer, 24-in., 625 ft.; 25 cu. yds. concrete; 100 cu. yds. rock excavation; time allowed, 60 days. MARTIN FINCK, Clerk of Board of Public Works, Jersey City, N. J. Jan. 16.

Pier and Crib Work.—Removing the existing pier and building new pier at W. 38th street, North river; and repairing crib bulkhead. THE DOCKS COMMISSIONERS, Pier A, North river, New York City. Jan. 16.

Pumping Engine, Pipe, Etc.—Pumping engine, boilers, cast-iron pipe, hydrants, etc. GEORGE W. PHELPS, Mount Morris, N. Y. Jan. 30.

Supplies—Broken stone, cement, sand, fire bricks and granite. JAMES FULTON, Paymaster General, U. S. N., Navy Department, Washington, D. C. Jan. 23.

Viaduct.—On 4th street, 1900 ft. JOHN DONNELLY, City Engineer, Kansas City, Mo. Jan. 28.

Pumping Engines.—Two engines with pumps and boilers complete, for the central pumping station. For constant use in connection with the water supply. Plans and specifications on file. GEO. B. SMITH, Commissioner of Public Works, Chicago, Ill. Jan. 30.

Sewers.—Plans and specifications at the office of the City Engineer. TAYLOR MILLER, Chairman of the Sewer Committee, Salina, Kan. Feb. 1.

Water-Works.—Capacity 20,000,000 galls. Plans and specifications on file. Extension of time. JOHN D. PAIGE, Mayor, Joliet, Ill. Feb. 1.

Contracting.

Dredging.—The Health Department, 301 Mott street, New York City, have 15,443 cu. yds. of mud and deposit to be removed from the Mott Haven canal; the work to be let by the cubic yard or by the job complete.

Street Cleaning.—At Buffalo, N. Y., the contract for cleaning the streets for 5 years has been awarded to Wm. Baynes for $51,500.

Submarine Pipe-Laying.—Messrs. Thacher & Breymann, of Toledo, O., have patented a method of and apparatus for laying pipe under water. It consists in a series of pipe lengths joined to form a section, buoying and floating the section into place and removing sufficient of the floats to sink it. The joint consists of a bell mouth, provided with a compressible lining, into which fits a tapered spigot end; collars encircle the pipe lengths, bearing against the bells of the respective lengths, and are connected by draw rods or bolts to draw and hold the sections together.

The Davidson Steam Pump Co., of 77 Liberty street, New York City, has been awarded a gold medal, by the Board of Government at the Massachusetts Charitable Mechanic Association, for its exhibit of steam pumps and pumping engines at the fair of the Association, recently held a Boston.

The Clayton Air Compressor Works, 43 Dey street, New York City, have an order from the Union Bridge Co., Athens, Pa., for one of the Clayton duplex air compressors, equipped with the patent air pressure governor and all the latest improvements.

Street Work.—*Danbury, Conn.*—The following proposals for granite paving were opened Dec. 28, by the Warden of the Borough: A. Brazos & Sons, Middlefield, Conn., $2.44½; C. W. Blakeslee & Son, New Haven, Conn., $2.70, $2.71, $2.73, on different streets; J. S. Bogart & Co., New York City, $2.90; Matthew Baird, New York city, $2.79; George W. Crane, Norwalk, Conn., $2.90; Doak & Beck, New York City, $2.93; J. H. Brown, New London, Conn., $2.90, $2.97.

Little Rock, Ark.—Proposals for sidewalk district No. 3, were received from Roberts & Weigel, John Coppin and Hy. Rudd. The prices were as follows: grading 10, 13, 8½ cts per lin ft.; tearing up old walks, 2, 4, 2½ cts. per lin ft.; new stone curb, 30, 29½, 30 cts. per lin ft.; new wood curb, 12, 11½, 10 cts. per lin foot.; brick walk 5 ft. wide, 42, 40, 40 cts. per lin ft.; take up and relay old gutters, 30, 23, 31 cts. per sq. yd.; alley returns $28, $20.80, $37 each; crossings, $38, $31.50, $57 each; brick work in cement, $190, $54, $45; earthwork, 24 cts. 18 cts., 20 cts.

Scranton, Pa., Water-Works.—The Scranton Gas & Water Co. has recently awarded to Burke Bros., of Scranton, the contract for building a dam and reservoir upon Stafford Meadow brook. It is intended to prosecute this work during the winter. Work upon the large storage reservoir at Dunnings (same company and same contractors; contract awarded last July) has been suspended for the winter. The final estimate for the Oak Run dam and reservoir, the contract for which was awarded las Decem-

ber to Burke Bros. by the same company, has been recently handed in. All of the above work is under the charge of E. SHERMAN GOULD, M. Am. Soc. C. E., Consulting Engineer of the Scranton Gas & Water Co., who prepared the plans and specifications for the same.

Sewers.—*Newark, N. J.*—For constructing a culvert in Riverside avenue, 8 bids were received by the Sewer Committee; the contract was awarded to Patrick Brady for 300 ft. of brick culvert, 42×48 ins. inside, with invert of stone blocks laid in Portland cement, $5.63 per ft.; for 3 basins with solid granite heads, $105 each; for 5 manholes, $27 each.——For a sewer in Magnolia and Bergen streets, 7 bids were received. The contract was awarded to James Conway and Terence McManus; 18 and 12-in vitrified salt glazed sewer pipe, $1.75 and $1.15 per ft.; basins, $100 each; manholes, $35 each.

Menominee River Bridge.—The following proposals were opened Dec. 30, 1887, at Menominee, Mich., for the construction of a bridge across the Menominee river in the cities of Menominee, Mich., and Marinette, Wis.: *Superstructure*, 1 iron drawbridge 192 ft. long and 8 iron spans of 110 ft. each; King Iron Bridge & Manufacturing Co., Cleveland, O., $29,948; Kansas City Bridge Co., Kansas City $30,120; Milwaukee Bridge Co., Milwaukee, Wis., $34,000; Wrought Iron Bridge Co., Canton, O. $34,800; Wisconsin Bridge & Iron Co., Milwaukee, Wis., $31,856; P. E. Lane, Chicago, $38,000; Massillon Bridge Co., Massillon, O., $38,700. The contract was awarded to the King Iron Bridge & Manufacturing Co. *Substructure*, masonry; Geo. Dan ison, Neenah, Wis., $26,010 (withdrawn); A. McGillis, Norway, Mich., $26,410; Milwaukee Bridge Co., Milwaukee, Wis., $27,000; Wisconsin Bridge & Iron Co., Milwaukee, Wis., $29,370; W. T. Casgrain, Milwaukee, Wis., $35,200. The contract was awarded to A. McGillis. A list of the former bids, which were all rejected, was given on p. 483, Dec. 31, 1887. R. E. FARNHAM, of Chicago, is Chief Engineer.

Bridge Contracts.—*Suffield, Mass.*—The Suffield selectmen have awarded to the Berlin Iron Bridge Co., of East Berlin, Conn., the contract for an 80 ft. iron bridge to replace the wooden structure over Stony Brook, on the road to Windsor Locks. It will be a parabolic truss bridge, with pin connections, and will be built as soon as new abutments can be built in the spring. The contract price is $1,550, which was the lowest of 8 bids.

Mechanicsville, N. Y.—The contract for the bridge across the Hudson river has been awarded to the Hilton Bridge Co., of Albany, N. Y. It will cost about $22,000.

Newark, N. J.—The following proposals have been received by ERNEST ADAM, City Surveyor, for an iron plate girder bridge across the Morris canal at Commercial street: clear span, 42 ft. 4 ins., wagon-way 26 ft. with a 6 ft. sidewalk on each side: Chas. O. Brown, Paterson, N. J. $2,263; New Jersey Steel & Iron Company, Trenton, N. J. $2,331; Passaic Rolling Mill Co., Passaic, N. J., $2,550.

Eutawville, S. C.—The Eutawville R. R. Co. has awarded the contract for a bridge across the Santee river and the trestle across Santee swamp, to S. J. Pregnalls.

Roslindale, Mass.—The granite arch bridge, known as Bussey bridge, on the Boston & Providence R. R., which replaces the iron structure that caused the serious railroad accident last year, has been completed. The contractors were Jos. Ross and F. H. Blaisdell. It was designed by S. L. MINOT, Chief Engineer B. & P. R. R., and was illustrated on p. 118 of the last volume.

RAILROADS

East of Chicago.

Existing Roads.

Indianapolis, Decatur & Western.—The reorganization of this company, which succeeds the old Indianapolis, Decatur & Springfield, is to be effected under the above name. A rumor is in circulation that the line will form a part of D. J. MACKEY'S Evansville & Terre Haute system.

Canadian Pacific.—A report from Kingston, Ont., states that control has been secured of the Rome, Watertown & Ogdensburgh and New York, Ontario & Western roads, thus securing an entrance to New York City for this Canadian company. This is "important if true;" but we apprehend the item will be as much news to the managers of the above roads as to every one else.

Upper Coos.—This New Hampshire road has been completed and opened for business from North Stratford, N. H., to the Canada line, a distance of 23 miles.

Allegheny & Kinzua:

OLEAN, N. Y., Dec. 31, 1887.

EDITOR ENGINEERING NEWS:

The Allegheny & Kinzua railroad will extend from a point on the N. Y. L. E. & W. R. R. near Bradford, Pa., through Corydon township, across the State line and through the township of Red House, Cattaraugus Co., N. Y., about 22 miles. The line is now being surveyed and contracts for building have been let to J. W. WATSON and D. SHINE of Olean, N. Y. The whole line to be finished by May 1, 1888. Work is light. Maximum grade is 200 ft. The line is built entirely for moving the products of the forests. C. D. WILLIAMS is Chief Engineer and Superintendent. S. S. BULLIS, *President.*

SOUTHERN.

Existing Roads.

Central R. R. of Georgia.—It is reported that through the agency of JOHN H. INMAN an alliance is to be effected between this Company and the Plant system of Railway and Steamship lines. It is further stated that the Central is to absorb the Anniston & Atlantic and Anniston & Cincinnati roads and that the narrow gauge will be changed to standard and the extension built at once from Sylacauga to Blockton and Talledega.

Atlanta & Florida.—The first division of this road from Atlanta, Ga., to Fayetteville has been completed and opened for business. The distance is 27 miles.

Kansas City, Memphis & Birmingham.—The first train was run over the Aberdeen branch Dec. 28.——The Coal Creek extension will leave the main line 15 miles west of Birmingham and be about 2 miles in length, work will begin at once.

New Projects and Surveys.

Marion, Princeton & Ohio River.—

MARION, KY., Dec. 28, 1887.

EDITOR ENGINEERING NEWS:

The proposed route of our road is from Marion, Ky., to a point opposite Elizabethtown, Ill., about 16 miles. The work will be very light and grades will be easy. Right of way has been secured and surveys will be made in January 1888, so that contracts for building may be let by early spring. R. W. WILSON is President. No Chief Engineer has yet been appointed.

JNO. W. BLUE, *Sec'y.*

THE NORTHWEST.

Existing Roads.

Pacific Ry. Co., in Nebraska.—A charter has been filed by the company for an extension from near Hastings, Neb., northwest to the west line of the State. It is difficult to see what the Missouri Pacific managers expect to gain by extending into a country thinly settled and whose traffic is already sharply contended for by the Burlington, Union Pacific and Northwestern companies, with a prospect that the Illinois Central, Rock Island, St. Paul and Manitoba, may also claim a share. However, the filing of a charter is a very short step toward building a road, and it is quite likely that when the line reaches Hastings, it will not go beyond that point for some time.

Minnesota & Southeastern.—Track has been laid on this road from Northern Pacific Junction, Minn., to Carpenter Mills, 9 miles, and the line is now under construction for 9 miles farther southeast, and under survey to Superior Junction, Wis., about 50 miles. The line is at present operated as a lumber road. ASA PAINE, of Northern Pacific Junction is Chief Engineer.

Tracklaying in 1887.—The press reports give the following statement of the extensions of principal systems in the Northwest during the past year: Manitoba, 942 miles; "Soo," 428; Illinois Central, 387; Chicago, Milwaukee & St. Paul, 321; Elkhorn, 358; Northern Pacific, 310; Kansas City, 306; South Shore, 204; Northwestern, 136; Omaha, 34; Wisconsin Central, 34; St. Paul & Duluth, 15; Minneapolis & St. Louis, 18; total, 3,534.

New Projects and Surveys.

Omaha & Plattsmouth Belt Line.—Incorporated by NATHAN SHELTON and others of Omaha, Neb., to build a belt railway about Plattsmouth and South Omaha.

Milwaukee, Peoria & St. Louis.—It is reported that this company will build next year a line from Milwaukee, Wis., to Peoria, Ill. The officers are stated to be W. F. DALRYMPLE, of Milwaukee; President, and GEO. H. NOYES, Secretary and Treasurer. This scheme seems to cover the same ground as the recently incorporated Peoria & Michigan.

Dubuque, Kansas City & Southwestern.

DUBUQUE, Ia., Dec. 27, 1887.

EDITOR ENGINEERING NEWS:

This road is projected to run from Dubuque to Kansas City by the most feasible route and will be surveyed early in the spring. Capital for building is partially secured. BERNARD J. O'NEIL, *President.*

Duluth, Red Wing & Southern.

RED WING, Minn., Dec. 27, 1887.

EDITOR ENGINEERING NEWS.

Surveys are nearly completed on this road from Duluth *via* River Falls, Red Wing, Zumbrota and Albert Lea to Sioux City, Ia., about 425 miles. Right of way is secured and contracts will probably be let in the spring, though capital is not yet definitely secured for building. F. W. HOYT, of Red Wing, is President.

G. H. CRARY, *Secretary.*

St. Paul, Black Hills & Pacific.

ABERDEEN, Dak., Dec. 27, 1877.

EDITOR ENGINEERING NEWS:

The St. Paul, Black Hills & Pacific Railroad is to run from Dickenson to Deadwood, Dak.; and from Aberdeen to Milnor, a total distance of about 278 miles. The line was placed under survey Oct 1, and right of way is now being secured. The enterprise is independent of existing roads, and capital for building is secured by a syndicate. Contracts will probably be let by April 1, and the line is to be completed by Jan. 1, 1889. S. H. JUMPER, of Aberdeen, is President, and W. L. RICHARDS, of Jamestown, is Chief Engineer.

L. G. JOHNSON, *General Manager.*

THE SOUTHWEST.

Existing Roads

St. Louis & San Francisco.—The report that the company is seriously considering the extension to Albuquerque, N. M., is corroborated by the departure of a surveying party from that point to locate the line eastward into the Texas Panhandle.

Missouri Pacific.—The press reports credit this company with 1,266 miles of tracklaying in 1887, a figure which is about 400 miles too large.

Natchitoches.—This Louisiana road has been opened for business from Prudhomme on the Texas & Pacific to Natchitoches, a distance of 15 miles.

New Projects and Surveys.

Kansas City, Watkins & Gulf.—The engineers of the company have completed the preliminary survey from Lake Charles to Shreveport, La., about 175 miles, and are now working down the Red River Valley. JABEZ WATKINS, Lake Charles, La., is interested.

Wichita, Richfield & Trinidad.—

RICHFIELD, KAN., Dec. 27, 1887.

EDITOR ENGINEERING NEWS:

The proposed route of this road is an air line from Wichita to Richfield, Kan., and thence to Trinidad, Col., a total distance of about 400 miles. Grades will not exceed 50 ft. per mile in Kansas and 75 in Colorado. Right of way is being obtained and surveys will begin March 1. Capital for construction is secured by paid up capital and bonds to be voted. Contracts will probably be let by May 1 so that tracklaying may begin by September and whole line be completed by Jan. 1, 1889. R. H. GENUNG is General Manager; no Chief Engineer has yet been appointed.

F. F. STEVENS, *President.*

Austin & McGregor.

BELTON, BELL CO., TEX., Dec. 28, 1887.

EDITOR ENGINEERING NEWS:

Our company has just been chartered and is gotten up by the towns along the line. The route is to be from Austin *via* Round Rock, Georgetown, Corn Hill, Salado and Belton to McGregor, 84 miles. A Chief Engineer will be appointed and the line placed under survey at once. Hon. Jos. NALLE, of Austin, is President. Hon. A. P. WOOLRIDGE, of Austin, is Secretary.

GEO. W. TYLER, *Director.*

ROCKY MOUNTAIN & PACIFIC.

Existing Roads.

St. Paul, Minneapolis & Manitoba.—Col. W. P. CLOUGH, President HILL'S assistant states that the stories that the Seattle Lake Shore & Eastern or any other Washington Territory company is backed by the Manitoba are pure fiction. The company has not yet decided to build farther west than the terminus of the Montana Central though it has for some time had parties in the field looking for favorable routes in case a Pacific extension should become advisable.

Mexican International.—This Southern Pacific extension in Mexico has been completed to a connection with the Mexican Central at Lerdo; about 250 miles of track has been laid this year.

San Pete Valley:

SALT LAKE CITY, Dec. 24, 1887.

Office of S. Bamberger, Gen. Manager.

EDITOR ENGINEERING NEWS:

The San Pete Valley Ry. Co., will build a 25 mile extension from their present terminus at Moroni to Nanti the location of the famous Temple of the Mormons in southern Utah. It is contemplated to complete it by April 1. Ties and rails are on the ground and grading will be begun as soon as weather permits. H. S. JOSEPH, C. E., is Chief Engineer of the California Short Line, by which name the extension will be known.

New Projects and Surveys.

San Pedro, Los Angeles & Utah.—

PASADENA, CAL., Dec. 22, 1887.

EDITOR ENGINEERING NEWS.

The surveys on this road, which were begun Sept. 20, are still in progress. There will be one large tunnel and several small ones in the Sierra Madre mountains, and one large bridge 180 ft. in height over Arroyo river. There is about 40 miles of heavy work in the mountains where max. grades are 150 ft. From San Pedro to Los Angeles the max. grade is 40 ft., on other portions 2% grades are the maximum. The total length is about 300 miles. Capital for building has been secured by an issue of bonds, and contracts for grading portions of the line will be let Jan. 1, to be completed in one year. It is expected to complete tracklaying on a part of the line and open it for business by May 1, 1888. J. P. WOODBURY is President of the company and A. B. MANAHAN is Secretary. J. M. WILLARD, *Chief Engineer.*

Anaheim, Olinda & Pomona.—This company has been incorporated at Anaheim, Cal., to build a road from near Long Beach to Pomona.

Mexico.—A press report from El Paso, Tex. says: WM. H. MCWOOD, a San Francisco capitalist, has secured one of the largest concessions ever granted by the Mexican government. The concession is for right of way for a railroad to begin at Tepic, state of Jalisco, and run northwest to Mazatlan on the coast, in the state of Sinaloa, thence northwest through that State, touching a number of important cities to connect with the Southern Pacific road at Yuma, Ariz. Work is to be begun in May, and will require three or four years for completion. A corps of surveyors will be in the field in 20 days.